Deanship of Graduate Studies

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The Efficacy of Continuous Passive Motion Device After Traumatic Knee Joint Fracture Versus Physiotherapy: A Randomized Comparative Trial Study for Improving Knee Joint Outcome

Qais Ibrahim Mohammad Saleh

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The Efficacy of Continuous Passive Motion Device After traumatic knee injuries: an experimental physiotherapy study for improving knee Joint outcome

Prepared By:

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Qais Ibrahim Mohammad Saleh

B.Sc. Physiotherapy, American Arab University (Jenin)

Supervisor

Dr. Esra' Hamdan

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Thesis Approval

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Prepared by: Qais Ibrahim Mohammad Saleh

Registration Number: 22112796

Supervisor: Dr. Esra' Hamdan

Master thesis submitted and accepted date:20/12/2023 and approved by:

Committee Members	**Signature**
Head of the committee: Dr. Esra' Hamd	**Signature:**
Internal Examiner: Dr. Akram Amro	**Signature:**
External Examiner: Dr. Motaz Alawneh	**Signature:** Motaz Alawna

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Dedication

To my dear homeland, Palestine

To the martyrs who were killed defending this dear country.

To the people injured by the occupying army who were a large part of this study

To my family

My father, who showed patience since childhood

My loving mother who gave me everything

My dear wife, who supports me in all my decisions

My dear brothers

My children Ibrahim and Ali

My friends and colleagues

To Dr. Esra Hamdan, who inspired and motivated me during the whole thesis writing process.

I'm grateful to the faculty and students at Al-Quds University for always motivating me to advance as a researcher.

Declaration

This thesis is being submitted to fulfill a portion of the requirements for the Master of Physiotherapy degree.

I thus declare that no other university or institution has received my thesis, in whole or in part, for consideration for a higher degree.

Signed: Qais

Date:20-12-2023

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Abstract

Background: In physiotherapy, continuous passive motion (CPM) devices are often used to improve joint range of motion (ROM) following severe knee fractures. However, the effectiveness of CPM is still debatable, especially with other knee joint outcomes. Many other physiotherapy techniques could be used during the early recovery time to improve knee joint outcomes such as pain, ROM and ADL.

Objective: The main objective of this study was to evaluate the effectiveness of (CPM) on early post-traumatic knee fracture as defined by pain and (ROM) as compared with non-CPM device users and that of regular physiotherapy (PT) treatment.

Methods: A randomized comparative design single-blinded with two groups was used. The study was conducted at Rafedia Hospital's Physiotherapy Department in Nablus, Palestine. A total of 70 post-traumatic knee fracture patients were assigned randomly to either the CPM (n=35) or traditional physiotherapy (n=35) groups.

Results: Both groups have shown an improvement. However, the CPM group had enhanced significantly compared to the control group in many knee outcomes such as in Oxford knee score (OKS), questionnaire, as there remained a significant difference in functional activity of daily living scores mean between pre- and post-test of the experimental group ($P< 0.05$). Also, the mean of the experimental group at the post-test ($M = 23.0 \pm SD\ 6.4$) was lower than the pre-test ($M = 40.6 \pm SD\ 7.7$). Furthermore, there were significant improvements in pain, ROM, in the CPM group compare to the control group.

Conclusion: CPM appears to be an effective method for decreasing pain, and restoring function, and knee (ROM) in individuals with knee fracture, according to the findings of this study. CPM has been shown to be more effective than traditional physiotherapy in terms of pain relief plus functional abilities. More study is required to validate these findings and identify the best length and intensity of CPM treatment.

Keywords

Continuous passive motion (CPM) Conventional physiotherapy, post-traumatic knee fracture, Pain, Functional ability, Knee range of motion (ROM), Muscle strength, Randomized controlled trial (RCT), Single-blinded

دراسة تجريبية لقياس فاعلية جهاز الحركات القصرية للمرضى الذين يعانون من محدودية الحركة في مفصل الركبة بعد الاصابة مقارنة بالعلاج الطبيعي

إعداد الطالب: قيس ابراهيم صالح
إشراف الدكتورة: اسراء حمدان

ملخص عن الدراسة باللغة العربية

المقدمة: في العلاج الطبيعي، غالبًا ما تُستخدم أجهزة الحركة السلبية المستمرة (CPM) لزيادة نطاق حركة المفاصل (ROM) بعد إصابات الركبة الشديدة. ومع ذلك، فإن فعالية CPM لا تزال موضع نقاش. كذلك فانه يمكن استخدام العديد من تقنيات العلاج الطبيعي الأخرى خلال فترة التعافي المبكر لتحسين نتائج مفصل الركبة وبالاخصالالم والمدى الحركي وفعاليات الحياة اليومية وغيرها.

هدف الدراسة: هدفت هذه الدراسة الى تقييم فعالية الحركة السلبية المستمرة (CPM) على تصلب الركبة المبكر بعد الكسر كما هو محدد بواسطة الألم و المدى الحركي (ROM) ومقارنتها مع استخدام تقنيات العلاج الطبيعي الاخرى .

المنهج المتبع للدراسة:.تم استخدام تصميم عشوائي مقارن أحادي التعمية مع مجموعتين. أجريت الدراسة في قسم العلاج الطبيعي في مستشفى رفيديا في نابلس، فلسطين. تم تعيين ما مجموعه 70 مريضًا بتصلب الركبة بعد الكسر بشكل عشوائي إما إلى مجموعات CPM (ن = 35) أو العلاج الطبيعي التقليدي (ن = 35).

نتائج الدراسة: أظهرت كلا المجموعتين تحسناواضحا مع العلاج . ومع ذلك، فقد تحسنت مجموعة CPM بشكل ملحوظ مقارنة بالمجموعة الضابطة في العديد من نتائج الركبة كما هو الحال في استبيان درجة أكسفورد للركبة (OKS)، حيث كان هناك اختلاف كبير في النشاط الوظيفي لمتوسط درجات الحياة اليومية بين الاختبار القبلي والبعدي. للمجموعة التجريبية (P<0.05). كما أن متوسط المجموعة التجريبية في الاختبار البعدي (M = 23.0±SD 6.4) كان أقل من الاختبار القبلي (M = 40.6±SD 7.7). علاوة على ذلك، كانت هناك تحسينات كبيرة في الألم، ROM، في مجموعة CPM مقارنة بالمجموعة الضابطة.

الاستنتاج:يبدو أن CPM هي وسيلة فعالة لتقليل الألم واستعادة الوظيفة ونطاق حركة الركبة لدى الأفراد الذين يعانون من تصلب الركبة بعد الكسر، وفقًا لنتائج هذه الدراسة. لقد ثبت أن العلاج الطبيعي CPM أكثر فعالية من العلاج الطبيعي التقليدي من حيث تخفيف الألم والقدرات الوظيفية. هناك حاجة إلى مزيد من الدراسة للتحقق من صحة هذه النتائج وتحديد أفضل طول وكثافة لعلاج CPM.

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List of abbreviations

CPM	continuous passive motion
PT	physiotherapy
ROM	range of motion
RCT	randomized controlled trial
NRS	Numeric Rating Scale

Chapter One.

1.1 Introduction.

1.2 Problem Statement.

1.3 Study Justification.

1.4 Study Objectives.

1.5 Study Questions

1.6 Study Hypothesis.

1.7 Terminology.

1.1 Introduction:

One of the most complex joints in the human body, the knee, is crucial to human movement. After an intra-articular or extra articular fracture , the knee may become stiff or have a limited range of motion. It is primarily caused by scarring-adhesions and intra and extra articular fibrosis in the quadriceps femoral apparatus (Judet, 1959; Nicoll, 1963; Xing et al., 2018).

The reported rate of knee intra articular fibrosis ranges from 4% to 35% (Abhishek Vaish, Raju Vaishya, & Vishwa Bandhu Bhasin, 2021), after traumatic knee injuries and external-fixation of the fractures, it occurs 14.5 percent of the time(Haller, Holt, McFadden, Higgins, & Kubiak, 2015).Injuries, infections, and surgeries performed on or near the knee joint are the most frequent underlying causes of knee stiffness (Stiefel & McIntyre, 2017).Intraarticular pathology is indicated when joint movement, both in flexion and extension, is restricted. At times, there can be an extra articular block to flexion (due to hard mass behind the knee joint) or owing to tight quadriceps muscle hold the knee on the front (as happens in the quadriceps fibrosis (Borzio, Pivec, Kapadia, Jauregui, & Maheshwari, 2016)).

An altered range of motion (ROM), decreased functional ability, poor quality of life due to restrictions on ADLs, knee instability, pain, decreased flexibility and strength, poor balance, abnormal walking gait, and affected proprioception are all possible outcomes of knee immobilization (Thaunat et al., 2016).Any cause of knee stiffness can cause pain and impairment in function because normal knee function and gait depend on a wide range of motion (Abhishek Vaish et al., 2021).

One of the common complications of knee injuries is post-traumatic fracture and loss of (ROM) with Adult Patients age above 18 years old, especially between 18-50 years.

Many causes of post-traumatic knee fracture can be broken down into three categories: flexion-contractures, extension-contractures, and combined-contractures. The knee's normal active range of motion (AROM) is 140° of flexion and 0° of extension. Thus, the inability to fully extend or straighten the knee is a flexion deformity of the knee, frequently referred to as flexion contracture. While, if a person has a 10 degree contracture and loss of

full knee extension with 130 degrees of knee flexion, it would be documented as extension-contractures (Liu et al., 2016). Hence, optimal knee function requires maximal restoration of knee extension. A residual flexion contracture decreases the patient's ability to walk, increases the energy cost, and slows velocity during ambulation. Limited knee extension range(Khatri, Bansal, & Rajpal, 2020; S. Liu et al., 2016).

The presence of extensive intra articular adhesions and/or the fibrotic transformation of articular structures can both contribute to post-traumatic fracture (Pujol, Boisrenoult, & Beaufils, 2015).

Physiotherapy treatment includes exercises and electrotherapy have an important effect in reducing knee stiffness(Kumar, Kaushal, & Kaur, 2020) . Continuous passive motion is one of the methods of the physiotherapy treatment for the reduction of knee stiffness (Castrodad et al., 2019).

Continuous passive motion (CPM), a machine is used to move a joint without the patient having to do anything. The physical therapist can adjust the amount of movement and speed as a motorized device gently bends the joint back and forth to a predetermined degree. The majority of knee joints are treated with CPM machines (Castrodad et al., 2019; Luo, Li, Mei, & Mao, 2021).A machine that moves passively and repeatedly provides this intervention. According to the literature, CPM has the following primary advantages: improvement in the range of motion, less pain and swelling, better local circulation, and less need for anesthesia-induced manipulation(Gil-González et al., 2022a).To reduce joint stiffness and improve joint range of motion, various treatments are available. (CPM) was used to overcome joint stiffness or improve (ROM), and progressive stretching with an orthosis was given to management contractures of the elbow joint, ankle joint, and knee joint in previous studies for post-traumatic fracture(Raghav, Singh, Tyagi, & Rastogi, 2018). Advantages and Disadvantage CPM machines bend joints, increase muscle power, reduce pain, and improve blood flow, but may not allow optimal hip joint movement due to field rehabilitation and hip adduction/abduction(Bhatt et al., 2023).

1.2 Problem Statement

Traumatic knee injuries can lead to decreased range of motion, pain, and swelling, which can negatively impact a person's ability to perform daily activities. The use of CPM devices in physical therapy may improve joint range of motion, reduce pain and swelling, and enhance

the recovery of knee joint after traumatic injuries(Erazo et al., 2022). However, In Palestine, there is a lack of studies on the therapeutic use and efficacy of CPM with post traumatic knee injuries, in particular after 6 weeks of knee fracture. Therefore, it is important to study the efficacy of CPM devices among the adults who have traumatic knee injuries , especially in outpatient physical therapy clinic for improving joint range of motion, reducing pain and swelling, and enhancing recovery outcomes in patients with traumatic knee injuries.

1.3 Study Justification "Rational":

The most common condition that may affect one functional ability is knee injuries caused by knee pain and restricted knee range of motion (ROM), which in turn can have a financial impact on the injured person as well as a negative influence on the patient's quality of life (C. Liu, Wan, Zhou, Feng, & Shang, 2017). In Palestine, CPM is now more and more used in physiotherapy clinics such as at Rafidia Governmental Hospital and it has become a part of daily care plans for patients post knee traumatic injuries. Thus, this study will explore and examine the efficacy of Continuous Passive Motion Devices after at least 6 weeks post knee fracture for improving knee Joint outcomes compared to standardized physiotherapy protocol.

1.4 The Study Aims & Objectives

Aim:

- ✓ The aim of this study will be to compare the effects of CPM on patients post at least 6 weeks knee fracture comparing to the effect of who received conventional or standardized physical therapy care.

Objectives:

- ✓ To assess the efficacy of conventional physiotherapy treatment on pain and range of motion for patients with 6 weeks post traumatic knee fracture.
- ✓ To evaluate the efficacy of CPM (continuous passive motion) on the prognosis of pain, and range of motion for patients with 6 weeks post traumatic knee fracture.
- ✓ To compare the efficacy of CPM and conventional physiotherapy treatment regarding the functional abilities of knee joint post 6 weeks of fracture.

1.5 Research Question:

1) What is the effect of CPM on the prognosis of functional activity in daily living compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture?
2) What is the effect of CPM on the prognosis of pain compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture?
3) What is the effect of CPM on the prognosis of knee range of motion compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture?

1.6 Study Hypothesis

- The use of CPM Machine is more effective treatment than conventional PT on Knee Joint pain severity & ROM and the functional ability among post traumatic knee patients.
- There is no significant effect for the conventional physiotherapy treatment on Post knee fracture at the level of $P \leq 0.05$.
- There is no effect of the personal variables age and gender on the prognosis of knee fracture post trauma at $P \leq 0.05$ when using CPM or conventional PT treatment.

1.7 Terminology

CPM device: Is a machine uses to change position a joint passively i.e., without the patient exerting any effort. A motorized device moves the joint continually to a set of number of degrees and movement speed, determined by the physiotherapist. CPM machines are most commonly applied to the knee joint, but there are types for other joints (Guidera, Hontas, & Ogden, 1990; Richter, Trzeciak, & Kaczmarek, 2022).

Isometric exercise: Are contraction of a specific muscle or group of muscles. During isometric exercises, the muscle doesn't obviously change length. The affected joint also doesn't move. Isometric exercises help go on strength (Laskowski, 2014; Onwunzo, Igwe, Umunnah, Uchenwoke, & Ezugwu, 2021).

Knee stiffness: A flexion deformity of the knee joint is the inability to fully straighten or extend the knee, also known as flexion-contracture. Normal active (ROM) of the knee is

0° extension to 140° flexion. An true definition of this would be limited knee extension range, both actively plus passively(Khatri et al., 2020).

Stretching exercise: Is an elongation of muscle with application of low force and long duration (usually 30 sec). Static stretching has a relaxation, elongation effect on muscle which increases range of motion (ROM), decreases Musculotendinous stiffness and also reduce the risk of acute muscle strain injuries(Kay & Blazevich, 2012).

Strengthening exercises: "Strengthening exercise is any exercise in which a person must exert force to complete a move. The opposite of active exercise is a passive exercise, in which another person moves the client's extremities to keep muscles from atrophying or better the client's range of motion(Hughes, Ellefsen, & Baar, 2018).

Trauma: Is a compound injury that can have far-reaching consequences for an individual, families, and society and it has the potential to be a significant public health load(Schneider, Isaac, Ross, & & Miller, 2017).

Chapter Two

Literature Review:

2.1 Theoretical Framework.

2.2 Similar Studies.

2.1 Theoretical Framework

2.1.1 Definition

Traumatic knee injuries are defined operationally as injuries to the knee joint carried on by external forces that may result in damage to the tissue. Pain, functional limitations, and decreased knee joint function can all be outcomes of these injuries(Mellinger & Neurohr, 2019). A "Continuous Passive Motion (CPM) device" is a therapeutic instrument that allows the knee joint to move in a regulated, repeated manner without requiring active patient effort. Enhancing the "knee joint outcome" involves a thorough assessment of variables such as pain alleviation, increased range of motion, functional recovery, and general improvement of the knee joint's health and functionality(Mellinger & Neurohr, 2019)

2.1.2 Incidence and prevalence

The demographic and study under consideration influence the incidence and prevalence of traumatic knee injuries. A predestined 6,664,324 knee injuries were reported to US emergency departments (EDs) among 1999 and 2008, according to research on knee injuries that occurred during that time. This translates to a rate of 2.29 knee injuries per 1,000 individuals(Gage, McIlvain, Collins, Fields, & Dawn Comstock, 2012). According to research, the incidence of knee injuries varies from 2.29 to 12 instances per 1,000 people annually, with patients between the ages of 15 and 24 accounting for the majority of those who have a knee injury(Evers et al., 2022). Knee injuries in Poland revealed that the most common age group of patients with knee injuries is between the ages of 11 and 20. Each year, knee injuries impact around 244,000 individuals(Bednarski & Piekarska, 2021). According to estimates, there are 720 cases of clinically confirmed soft-tissue knee injuries per 100,000 people in southern Sweden each year(Peat, Bergknut, Frobell, Jöud, & Englund, 2014). According to reports, the US has a rate of 68.6 isolated cruciate ligament injuries per 100,000 person years Knee injuries also have an impact on the incidence of post-traumatic knee osteoarthritis (PTOA). The most frequent traumas that lead to the development of PTOA are meniscal and cruciate ligament lesions(Evers et al., 2022).

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2.1.3 Anatomy and Physiology

The knee joint comprises of 2 articulations—the patellofemoral and tibiofemoral. Stability of the joint is governed by a combination of static ligaments, dynamic muscular forces, meniscocapsularaponeurosis, bony topography, and joint load. (Flandry, F., et al., 2011)

Figure 1: Shows the anatomy of the knee joint.

2.1.4Components of knee stiffness

no.	Intra-articular components	Extra-articular components
1	Intra-articular adhesions	Quadriceps muscle adhesions to femur bone, aponeurosis, and inter muscular septum
2	Excessive proliferation of fibrous tissue scar	Retraction of muscle due to scan formation
3	Retraction of per-articular soft tissues	Adhesion of skin in the deeper layers
4	Bone impingement due to intra-articular mal union(Abhishek Vaish et al., 2021; A. Vaish, R. Vaishya, & V. B. Bhasin, 2021)	

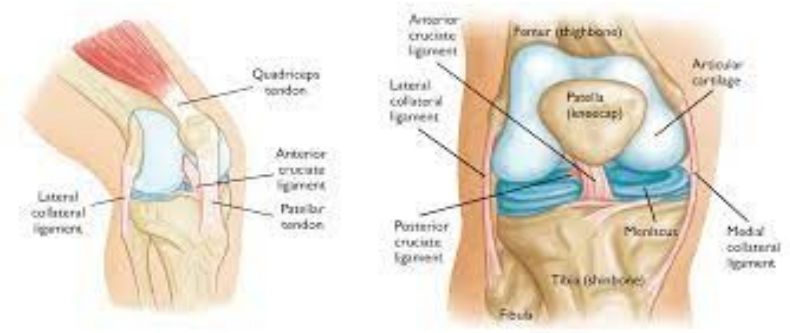


Figure 2: Shows the intra / extra articular components of the knee joint.

2.2.5 Complications post Knee Injury

In clinical practice, ankylosis, or knee joint-stiffness, is a prevalent provision. Knee intra-articular fibrosis has a documented incidence ranging from 4 to 35%. After traumatic knee inj uries (of the knee) and external fixation of the fractures, it occurs frequently (14.5%. The issu e of knee stiffness following knee operations like anterior cruciate ligament (ACL) reconstruc tion and total knee arthroplasty has been thoroughly researched (TKA). It may or may not be accompanied by pain, but it typically leaves the patient significantly disabled and is difficult t o treatSince the normal motion and function of the knee depending on a wide range of motion , any cause of knee stiffness may result in pain and functional dysfunction(Stiefel & McIntyre, 2017).

Figure 3: Shows the complications of the knee joint.

2.2.3 Causes of knee stiffness (Abhishek Vaish et al., 2021)

- Post-traumatic (fractures in and around the knee joint)
- Post-inflammatory and infective joint disease
- After cast immobilization
- Scarred skin (post-burn contractures, post-traumatic)
- After excessive massage (e.g., by quacks)
- Postoperative

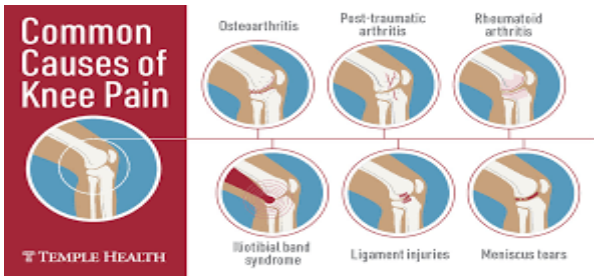


Figure 4: Shows the causes of the knee joint.

2.2.6 Treatment options for stiff knees

Arthrofibrosis-related knee stiffness can be treated in a number of ways. Physiotherapy, anesthesia-assisted manipulation, arthroscopic surgical release, and open release with or without quadriceps_plasty are examples of these Physiotherapy Knee exercises, physiotherapy modalities (e.g., ultrasonic, TENS, wax, etc.), continuous passive motion (CPM)(Abhishek Vaish et al., 2021).

2.2.7 Physiotherapy management for knee trauma.

Physiotherapy plays an important role for the reduction of knee stiffness; physiotherapy treatment includes many modalities such as exercises and electrotherapy (Kumar et al., 2020). One of these techniques is continuous passive motion is used for the reduction of knee stiffness (Castrodad et al., 2019).

2.2.8 Continues Passive Motion CPM Machine:

It was Salter who first introduced the continuous passive motion (CPM) device, which automatically bends or stretches the knee joint slowly Effective for preserving range of motion, promoting joint tissue regeneration, and preventing joint contracture(Salter et al., 1986). CPM devices have been the focus of numerous scientific studies(Tagami, Hasegawa, Tanahara, & Tagawa, 2022). When utilizing CPM devices, it is crucial to exercise caution in order to avoid placing excessive strain on the knee joint. Research methods from a variety of viewpoints, including mechanics, actuators, and control schemes, have been documented because this affects more than just the knee joint(Singhal, Pavlou, & Shah, 2022). The majority of knee CPM devices use a slider-crank mechanism. However, an overload may occur due to the mechanical structure of the knee joint differing from that of the mechanical structure. Utilizing mechanism design is one strategy to solve this problem(Rajestari, Feizi, & Taghvaei, 2017).

When using a CPM device to train passively motion, rehabilitation therapy is not complet acti ve exercises must be added dependent on how well the patient is recovering. Patients must str etch or bend their joints during physical activity, which has an impact on muscle.
Recovery and the activation of motor nerves.it has been stated that adding a component

for physical exercise or assistance to the traditional CPM (De Meurechy, Loos, & Mommaerts, 2019)

Figure 5: Shows the continuous passive motion machine.

2.2 Similar Study

Comparison of the functional results of early and conventional CPM therapy in the treatment of tibia plateau fracture. The study's initial inclusion criteria comprised 120 patients with tibia plateau fractures. In comparison to the group receiving regular physiotherapy, the outcomes in the 6 subscales for early CPM physiotherapy patients were better. Compared to the group

receiving standard physiotherapy, early CPM physiotherapy patients' overall patient function is more satisfying(Mohammad hoseini et al., 2022).

2.2.1 Global Studies

A Clinical Trial using Randomization the study included 30 participants in a double-blind, random clinical trial, of whom 7 were female and 23 were male. The purpose of the study was to compare the effects of mobilization with movement and traditional treatment on individuals with post-traumatic fracture of the knee joint. Using goniometry and a VAS score, the range of motion in the knee joint and pain were evaluated, respectively. After the 4 weeks of the intervention were up, the subjects underwent another evaluation. The findings revealed a significant difference in pain and (ROM)measured by their VAS and goniometry scores, respectively (p=0.001(Raghav et al., 2018).

Knee arthrofibrosis can be effectively treated with medical stretching devices Systematic review of the following inclusion criteria were used to choose articles:

1) Patients with knee arthrofibrosis, stiffness, or contracture, excluding individuals with hematological or neurological conditions, as well as those who are bedridden or immobile.

2) Patients receiving ROM deficiency therapy who stretch with a medical device.

3) Peer-reviewed journal articles only; case studies and case series are not permitted.

4) Only human subjects are used in English-language articles.

Result of this Systematic review the inclusion criteria were met by a total of 13 studies (558 individuals), with the stretching devices falling into the categories of CPM, load control, or displacement control. CPM, load-control, and displacement-control trials all showed a statistically significant increase in the range of motion The outcomes demonstrate that, in comparison to displacement-control and patient-actuated serial stretching devices, the stretch doses delivered using CPM, and load-control devices were done more than a significantly longer intervention period and entailed significantly more extra physiotherapy(Aspinall et al., 2021).

Long-Term Continuous Passive Movement Application Enhances Postoperative Tibial Head Fracture Recovery. 60 randomly and equally divided into the CPM group and non-CPM group. Both groups immediately received CPM and conventional physical therapies during

hospitalization. A Prospective Randomized Controlled Study the ROM was noticeably higher in the CPM group at both follow-up time points. The CPM group performed noticeably better than the non-CPM group in terms of the Knee Society Score, UCLA activity score, the EuroQoL, and pain analysis (C. Kabst et al., 2022).

In 2012, the same group that conducted the RCT by Herbold et al. conducted a retrospective comparative study to compare the outcomes of using CPM with those of a cohort of 61 in patients who also had poor initial ROM—defined as less than 75° of active knee flexion at the time of admission—and were coordinated for a postoperative day at admission, age, length of stay, and Health Insurance Prospective Payment System (HIPPS) code.**Intervention:** Use of CPM for 2 hours per day as an addition to the Three hours of physical and occupational therapy customary The outcomes of using CPM were 29% of the 633 patients with poor initial ROM used CPM (2 hours/day), as determined mainly by the referring physician. The duration of stay was on average 7.85 days. There were no significant differences in functional scores or outcomes at discharge, including knee flexion or extension, community discharge, want for home care, and need for an assistive device(Herbold, Bonistall, & Blackburn, 2012).

Rogan and colleagues (2013) conducted a systematic review to assess the treatment effects of CPM following surgical cartilage repair. The CBO/Dutch Cochrane Centre Guideline was used to check systematic reviews. In the beginning, 1,541 studies were retrieved from the databases. One review and ten original papers could be included for further evaluation after being screened for inclusion criteria. A meta-analysis was prevented by the heterogeneity of the outcome measures and the fact that six of the nine studies with a one-group pre-post design measured the combined effect of surgical treatment and CPM(Herbold et al., 2012).

According to Ram et al. (2019), joint immobilization following ACL R may result in ROM deficits and intra-articular adhesions; Consequently, post-operative CPM machine protocols were advocated by some practitioners. However, previous studies have not demonstrated that CPM improves post-operative ROM. However, it has been demonstrated that in adult populations, rates of arthrofibrosis requiring manipulation under anesthesia (MUA) are decreased by continuous passive motion. CPM's efficacy after ACL reconstruction in a pediatric population has not been studied to date. The researchers looked at whether the use of CPM would lower arthrofibrosis rates in pediatric patients (those under 20 years old) who underwent primary ACLR in a cohort, retrospective study. Reduced knee flexion necessitating MUA within six months of surgery was deemed clinically significant arthrofibrosis. 163

patients were included in the final dataset. At the 1-week, 1-month, 3-month, and 6-month time points, there was no significant difference in ROM between cohorts (p = 0.137, 0.695, 0.897, and 0.339, respectively). At these time points, the pain scores of the two groups also did not differ significantly (p = 0.684, 0.623, 0.507, and 1.000, respectively). At three and six months, neither the strength of the hamstrings nor the quadriceps differed significantly between the cohorts; Within six months of surgery, four patients (7.4%) in the no-CPM cohort required MUA for arthrofibrosis, whereas none of the CPM patients required MUA (p = 0.023). The study's authors concluded that the use of CPM machines reduced arthrofibrosis in pediatric patients undergoing ACLR that necessitated MUA. In addition, these researchers stated that future research may provide a more precise definition of CPM's clinical utility and cost-effectiveness in rehabilitation following these surgeries(Bram, Gambone, DeFrancesco, Striano, & Ganley, 2019).

Andrade and colleagues (2020) summarize recommendation and evaluated the quality of international clinical practice guidelines (CPGs) for rehabilitation following ACLR in a systematic review. Muscle and strength training. Cryotherapy, neuromuscular electro-stimulation, early full weight-bearing exercises, and early open and closed kinetic-chain exercises can all be utilized depending on the individual circumstances. Advise against CPM and utilitarian supporting. The authors came to the conclusion that the quality of the CPGs for ACL post-operative rehabilitation was superior, and that strength/neuromuscular training and immediate knee mobilization should be used. Additionally, these researchers recommended avoiding functional bracing and CPM(Andrade, Pereira, van Cingel, Staal, & Espregueira-Mendes, 2020).

Kuroda et al (2021) expressed that the utilization of CPM in muscular recovery has been around for a considerable length of time and is most generally detailed after TKR; and has primarily been recommended for enhancing knee flexion recovery. A recent meta-analysis revealed moderately statistically significant evidence that CPM improved functional recovery, reduced pain, and restored knee ROM(Kuroda et al., 2021).

2.2.2 Summary:

The majority of studies lack specific, uniform physiotherapy and rehabilitation protocols; consequently, there are still disagreements regarding the selection of various techniques, strategies and their efficacy. In order to evaluate the efficacy of specific techniques based on the stage of healing, well-designed RCTs with a larger sample size are required. It is evident

that additional research in these areas is required. To put it another way, it is necessary to investigate the advantages and disadvantages of various forms of exercise over others, particularly in terms of achieving both short-term and long-term objectives.

Chapter Three

Methods and Materials:

3.1 Study design.

3.2 Study setting.

3.3 Study sample.

3.4 Data collection.

3.5 Suggested program.

3.6 Statistical analysis.

3.7 Ethical considerations.

Chapter Three

Introduction

This chapter focuses on the presentation of the sampling method, sample size, inclusion and exclusion criteria. Additionally, it discusses the research methodology, including the design, data collection tools and procedure, study intervention, and statistical analysis. Furthermore, it addresses the ethical considerations of this study.

3.1 Study design

A randomized controlled trial design with single- arm blinded as patients did not know which study group they are in(Lee et al., 2022).The study had two groups that was used to compare the effectiveness of a continuous passive motion (CPM) device comparing to a conventional physiotherapeutic program for patients with post-traumatic knee fracture.

3.2 Study Setting

The research was carried out at the Physiotherapy Department of Rafedia Hospital in Nablus, West Bank Palestine. Rafedia Surgical Hospital is a public hospital in the northern part of the West Bank with a total capacity of 200 beds, which includes a 19-bed orthopedic surgery unit. The procedure of open reduction and internal-fixation (ORIF) to stabilize and align the bones is a typical surgical treatment for severe knee injuries in Rafedia.

3.3 Study Sample

3.3.1 Sampling Methods

Simple random sample method was chosen for this study as it was easier for the recruitment of the patients, in particular those who are recruitment from Rafidia governmental hospital.

Usually there are an average of 20-30 new patients per week to be admitted to the physiotherapy department regardless of their diagnosis. Further a period of implementation of 3 weeks

according to the waiting list by the orthopedic clinics, Thus, the first step was to rule out who are the patients who are diagnosed with post knee injury. Then, the researcher had the idea of given the experimental group had odd number (1,3, 5, etc) while the control group had an even number (2,4,6 , etc). Therefore, for at least of having 60 patients in both groups, the researcher used the simple random sampling.

3.3.2 Sample Size

In accordance with the use of clinical judgment as well as with a sample size calculator in order to specify the smallest effect size to consider to be relevant to this study. The researcher decided to recruit patients from the period from March 2023 up until September 2023. By the end of September 2023, we had a total of 70 patients.

The 70 patients' codes were randomized into either the experimental group (n=35) or the control group (n=35) using Excel Sheet.

3.3.3 Inclusion criteria

- Adult-Patients age above 18 years old, especially between 18-50 years.
- Patients with post traumatic knee stiffness ≥ 6 weeks, or according to orthopaedic surgeon order.
- Willing to participate in the study and sign the consent form.
- Both gender (Male and Female was included).

3.3.4 Exclusion criteria

- Patients below 18 years old and above 50 years old
- Patients with nonunion fracture or Mal _union Fracture or before 6 weeks of knee #
- Osteoporosis disorder.
- Osteoarthritis stages 2,3 & 4
- History of malignancy or carcinoma in the area of treatment
- Localized infected wound or soft tissue in the area of treatment

3.4 Data collection:

3.4.1 Tools of data collection.

- **Demographic and clinical characteristics Sheet**.

A personal data collection form, encompassing demographic and clinical characteristics, was utilized to gather information pertaining to the patient. (A self-designed questionnaire includes the following personal data information; composed of 5 items to assess age, gender, occupation, marital status, BMI educational level, medical history and surgical history).

3.4.2Primary Outcomes

- **Visual Analogue Scale (VAS) (Klimek et al., 2017).**

It is a psychometric measuring tools that was designed to document a variety of disease-related symptom severity in individual patients in a way that is statistically measurable and reliable.

The severity of pain is measured on a scale from "0" representing no pain , 1-3 representing mild pain , 4-6 representing , moderate pain , 7-9 representing pain while 10 representing the worst intense pain ever experienced.

The assessment of pain has been widely recognized as a valid, reliable, and responsive technique.

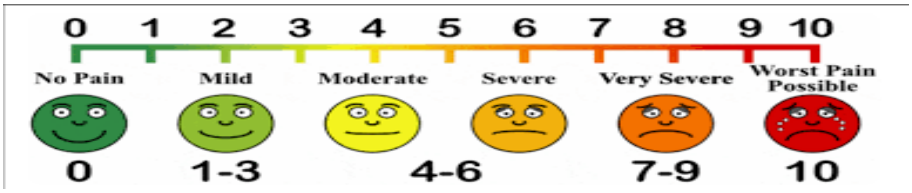


Figure 6: Shows the Visual Analogue Scale

- **Oxford Knee Score (OKS) Questionnaire**

It consists of 12 questions. That evaluate knee joint in Activities of daily living. It is validated and had an Arabic translation OKS was first developed; care was taken to make it as easy to use as possible. The original scoring system was 1-5, with one being the highest score. However, clinicians thought this was actually confusing and adjustments were made, so the

original author developed a new scoring system from 0 to 4. (Ahmed, Said, Ramadan, Abd El-Radi, & El-Assal, 2019; Maempel, Clement, Brenkel, & Walmsley, 2016). (Appendix)1.

3.4.3 *Secondary* Outcomes

- **Range of motion test:** To evaluate and measure knee range of motion using goniometer.

Goniometer: A goniometer is a tool that measures the available (ROM) at a joint. The art and science of measuring the joint ranges in each plane of the joint are called goniometry (Gitau, Kulankash, Wanjema, & Maina, 2023) This tool provides a valid and reliable means of assessing the effectiveness of an intervention.

Figure 7: Shows the goniometer tool.

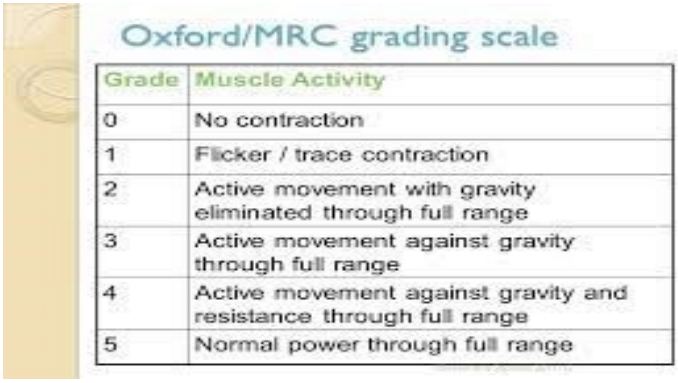
Knee ROM

- The patient is on prone position. Then, the researcher places the center of the goniometer over the lateral epicondyle pf the know joint. The stationary arm goes along the lateral mid-thigh toward the greater trochanter when doing know flexion. While for knee extension, patient is in prone with test-side ankle off plinth. The stationary arm goes along the femur to the greater trochanter and the movement arm goes along the fibula to lateral malleolus.

ROM	• Female	• Male
• Knee flexion	• 141.9 (140.9 – 142.9)	• 137.7 (136.5 – 138.9)
• Knee extension	• 1.6 (1.1 – 2.1)	• 1.0 (0.6 – 1.4)

- Normal range of motion (knee flexion and extension) for both gender ucie et al., 2011).

- **Knee Muscle Strength**: It is an objective assessment, to assess the muscle strength. The Oxford Scale (AKA Medical Research Council Manual Muscle testing scale) (Naqvi, 2022)



Oxford/MRC grading scale

Grade	Muscle Activity
0	No contraction
1	Flicker / trace contraction
2	Active movement with gravity eliminated through full range
3	Active movement against gravity through full range
4	Active movement against gravity and resistance through full range
5	Normal power through full range

Figure 8: Shows the Oxford Scale.

For testing knee flexion muscles, have the patient in supine position. Then flex the knee to around 30 degrees. Give resistance above the ankle and ask the patient to bring the heel to the buttocks. While for testing know extension muscles, have the leg rest on therapist underarm and ask the patient to resist.

- **Knee Circumferences**

Measurement is taken around the knee at level of patella for joint swelling and 5cm above and below the border of patella for muscle wasting(Adnan, Ligia, & Bediwy, 2021).

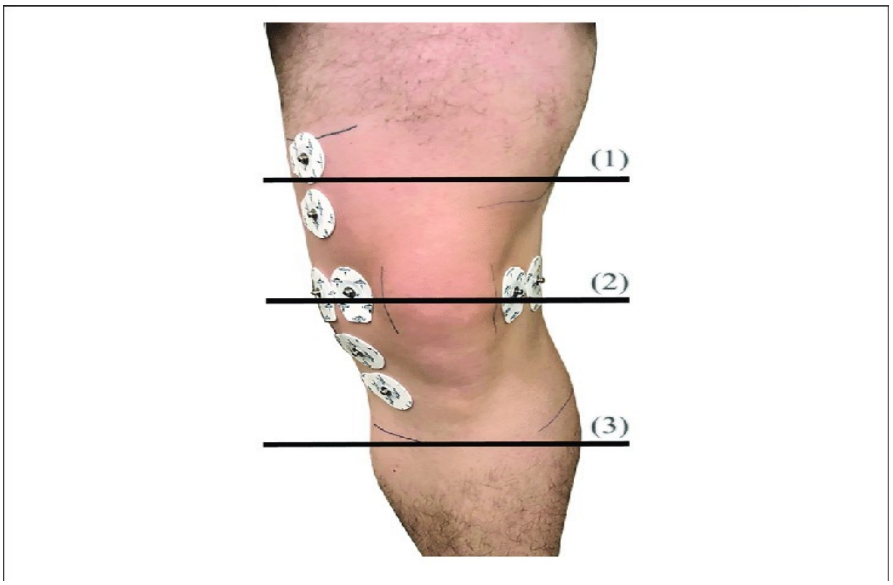


Figure 9 Knee Circumferences(Critcher & Freeborn, 2022)

3.4.2 Study Procedure:

All patients in the **Experimental group** included (Applying the CPM device on the knee joint, based on scientific evidence to increase knee flexion gradually, this device will apply once daily for 30 minutes (3 times by week) for 10 sessions (Aspinall et al., 2021). In addition to the regular physiotherapy program of isometric exercise, strengthening exercises, and home program.

While all patients in the **Control group** included (Applied stretching exercises to the knee joint, based on the scientific evidence to increase knee flexion gradually.(Aspinall et al., 2021).In addition to the regular physiotherapy program of isometric exercise, strengthening exercises, and home program.

3.5 Suggested Program

The program of the intervention group consisted 30 Patients in the experimental group will get physiotherapy that includes the use of a Continuous Passive Motion (CPM) device on the knee joint. This device, which is based on scientific data to progressively develop knee flexion, will be used once a day for 30 minutes, The training program includes a total of ten sessions, which are conducted three times a week. (Sara K. Aspinall et al., 2021). Participants in the experimental group will also participate in a regular physiotherapy program that includes isometric exercises, strengthening exercises, and a home exercise program. Precautions have been taken, and patients will be allowed not to continue using the CPM device or any other exercise if they suffer discomfort, or pain, or encounter any of the provided dangers.

Control group 30 patients the intervention comprises the administration of stretching exercises to the knee joint, with the goal of gradually increasing knee flexion in the control group. This program, which is also based on scientific data, was implemented three times a week for 30 minutes, for a total of ten sessions (Sara K. Aspinall et al., 2021).

The control group, like the experimental group, follow the typical physiotherapy regimen, which includes isometric exercises, strengthening exercises, and a home instruction.

Table 3.1: Physiotherapy Intervention

Exercise program. Patients in the control group will be told to stop stretching exercises or any other activity if they experience discomfort, pain, or any of the dangers indicated.

Intervention	*Consist of*	*Precautions*
CPM device 	- The patient on supine position. - The patient's leg will be fixed on the CPM device. - Starting with 30- 45-degree flexion. - The angle will increase 10 – 15 degree per session according to the patient tolerance. - Time of applying 30 minutes per session, 3 times per week for 10 sessions. (Sara K. Aspinall et al.,2021)	- Patient will ask to stop exercise if any discomfort of pain or any risk will be happened.
Stretching exercises 	- Applied in supine, prone and on the edge of bed to increase knee flexion. - Knee flexion will increase gradually according to patient tolerance. - Exercises will apply once time per session for a duration of 30 minutes, with a repetition of each exercise 15 times in a set of exercise. 5 minutes rest between each set of exercise (2 sets), 3 times per week for 10 sessions (Sara K. Aspinall et al.,2021)	- Patient will ask to stop exercise if any discomfort of pain or any risk will be happened.
Isometric exercise 	- The patient on supine position. - By holding the knee joint on a towel or pillow with no joint or muscle movement. - Maintaining holding for 5 seconds, with a repetition of 10 times (with a frequency of 2 times). (Jennifer Mathe, et at., 2022)	- Patient will ask to stop exercise if any discomfort of pain or any risk will be happened.
Strengthening exercises 	1. Knee bends – 3 sets of 10 repetitions (reps) ... 2. Thigh contraction – 3 sets of 15 seconds with each leg. ... 3. Straight leg raises – 3 sets of 10 reps with each leg. ... 4. Hamstring stretch with thigh contraction – 3 sets of 15 seconds with each leg. ... 5. ITB (iliotibial band) – 3 sets of 15 seconds with each leg. (Matthew N Bourne. Et al.,2018).	- Patient will ask to stop exercise if any discomfort of pain or any risk will be happened.
Home program 	Home exercises will be trained to the patient (isometric exercise, and active exercise).	-Precautions will be explained to the patient verbally and by paper instructions.

3.6 Statistical analysis

The Statistical Package for the Social Sciences (SPSS) package, version 23 (SPSS Inc., Chicago, IL), was utilized for conducting the statistical analysis. Descriptive statistics, including frequencies, means, and standard deviation, were employed to describe the sample in terms of age and sex. Inferential statistics, such as the Independent sample t-test and paired sample t-test, were conducted on parametric variables to identify any disparities between the

two groups. Additionally, the researcher employed person correlation for continuous variables. The threshold for statistical significance was set at $P < 0.05$.

3.7 Ethical Considerations

The MPT committee, along with the Research Ethical Committee at Al Quds University and the Palestinian Ministry of Health, granted approval for the study in accordance with the Declaration of Helsinki. The approval was taken from the Rafidia hospital manger as well Appendix 2 .

Prior to their inclusion in the study, participants were provided with comprehensive information regarding the procedures and objectives. They were given the freedom to decline participation or withdraw from the study at any point without facing any limitations. Written informed consent was obtained prior to randomization, and all patient records were handled with confidentiality and ensuring patients privacy.

Chapter Four

Results Presentation, Analysis & Discussion:

4.1 Results Presentation and Analysis.

4.2 Results Discussion.

4.3 Study Limitation.

Chapter Four

4.1 Results presentation and analysis.

In this chapter the findings of the study are presented. The main objective of this research was to compare the impact of CPM on patients in the early stages of knee trauma with those who received standard physical therapy. The data was analyzed using the statistical package for social science (SPSS, version 23). To address the research inquiries, both descriptive and inferential statistics were employed. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were used to describe the participants' characteristics. On the other hand, inferential statistics, including independent t-test, paired t-test, and X2, were utilized to examine the research questions.

4.1.1 Participant Assignments

Seventy participants met the eligibility criteria and agreed to participate in the study. The patients were allocated to two groups. The two groups were assigned in a random manner to either an intervention group or a control group (see Figure 4- 1).

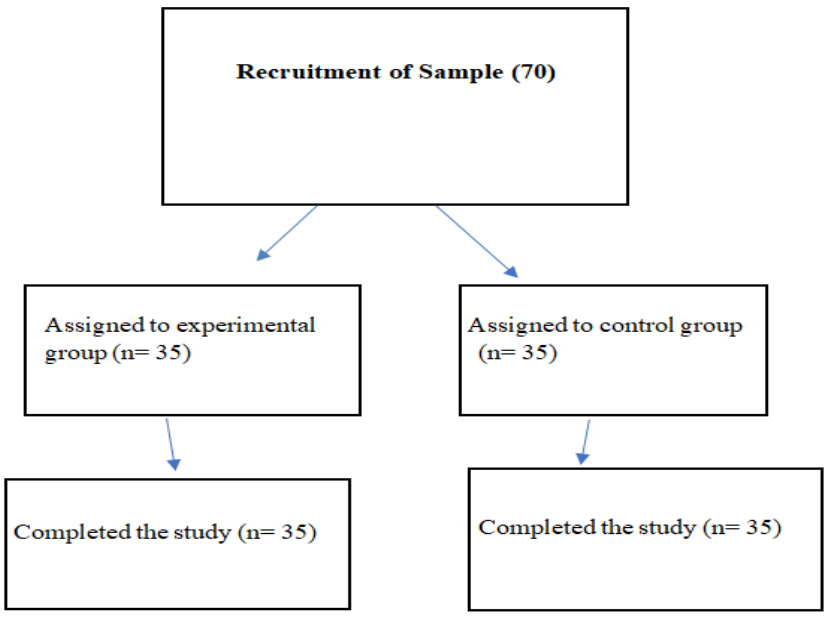


Figure 4-1 Sampling and Flow of Subjects through Study.

4.1.2 Description of the participant's socio-demographics characteristics

The analysis revealed that 24(34.3%) of the participants were between 30-39 years old.

The majority of them as a gender, 54 (77.1%), were males, and 25 (35.7%) had a bachelor's degree. More than half of them, 36 (51.4%), were married, and 23 (32.9%) were workers.

The body mass index of the participants 32(45.7%) was overweight, as seen in Table 4-1.

Table 4-1. Description of Participants socio-demographics (N =70)

Variables		Total N(%)	Control N(%)	Experiment N(%)	Test statistics	*P*-value
Age	less than 20 years	2(2.9)	2 (100.0)	0(0.0)	X^2 =2.894	0.408
	20-29 years	22(31.4)	11(50.0)	11 (50.0)		
	30-39 years	24(34.3)	13(54.2)	11(45.8)		
	40 years and above	22(31.4)	9(40.9)	13(59.1)		
Gender	Male	54 (77.1)	25 (71.4)	29 (82.9)	X^2 = 1.296	0.255
	Female	16 (22.9)	10 (28.6)	6 (17.1)		
Level of education	Primary	20 (28.6)	9(25.7)	11(31.4)	X^2 =1.560	0.458
	Secondary	25 (35.7)	11(31.4)	14 (40.0)		
	Bachelor	25 (35.7)	15(42.9)	10 (28.6)		
Marital status	Single	24 (34.3)	14(40.0)	10(28.6	X^2 =1.111	0.574
	Married	36(51.4)	16(45.7)	20(57.1)		
	Other	10 (14.3)	5(14.3)	5(14.3)		
Occupation	Trader	12 (17.1)	5(14.3)	7(20.0)	X^2 =8.419	0.209
	housewife	9(12.9)	6(17.1)	3(8.6)		
	Worker	23(32.9)	12(34.3)	11(31.4)		
	Student	7(10.0)	6(17.1)	1(2.9)		
	Employer	17(24.3)	6(17.1)	11(31.4)		
	Teacher	1(1.4)	0(0.0)	1(2.9)		
	Driver	1(1.4)	0(0.0)	1(2.9)		
BMI	Normal weight	22(31.4)	11(50.0)	11(50.0)	X^2 =1.500	0.472
	Overweight	32(45.7)	14(43.8)	18(56.3)		
	Obesity	16(22.9)	10(62.5)	6(37.5)		

P. value significant at the 0.05 level

X^2*:* A chi-square (χ^2) statistic is a measure of the difference between the observed and expected frequencies of the outcomes of a set of events or variables.

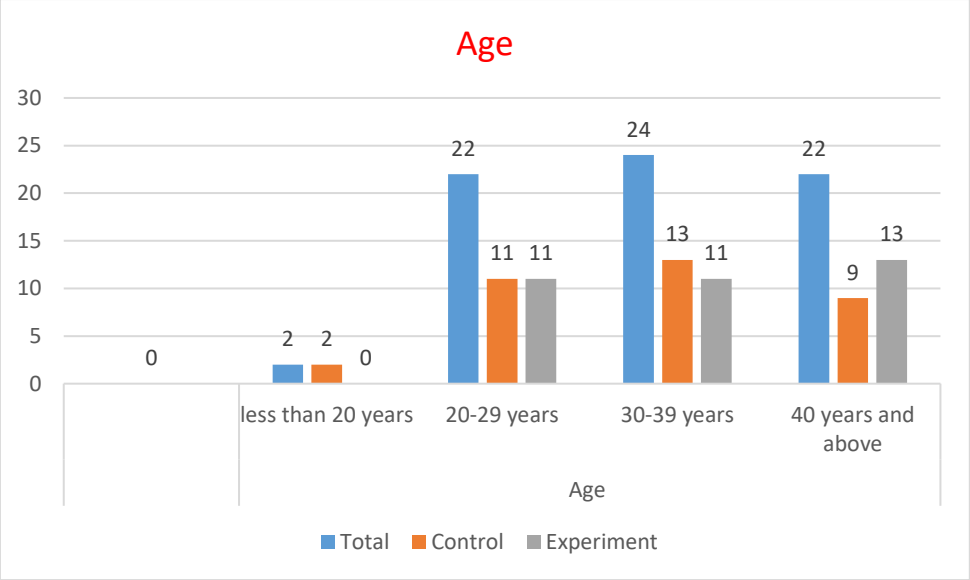


Figure4.2 Description of Participants socio-demographics (N =70)

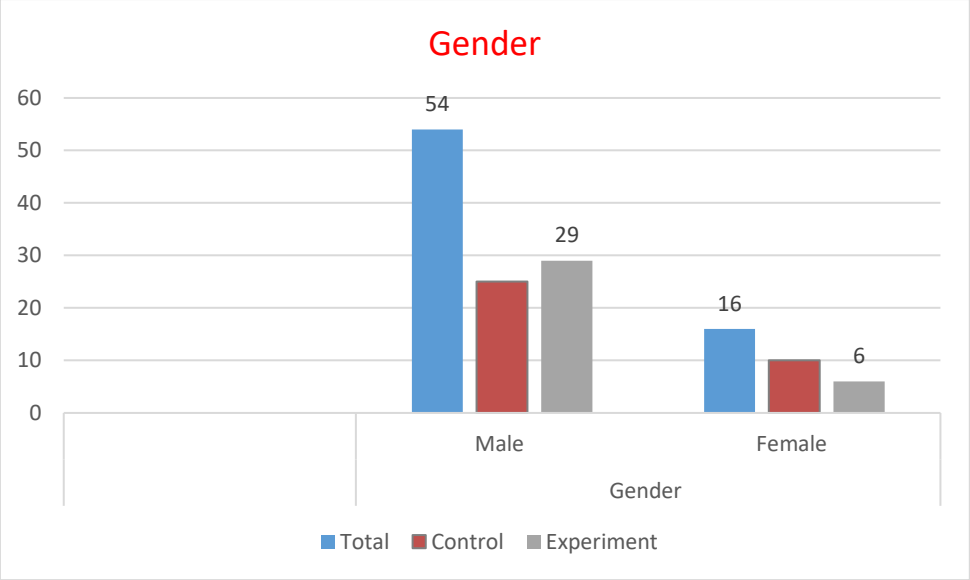


Figure 4.3 According to gender

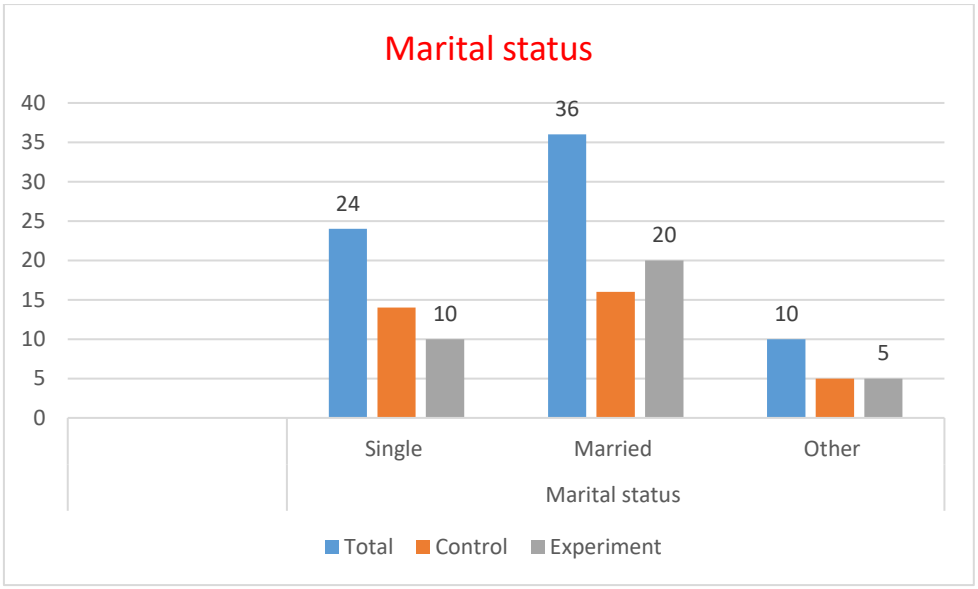


Figure 4.4 According to marital status

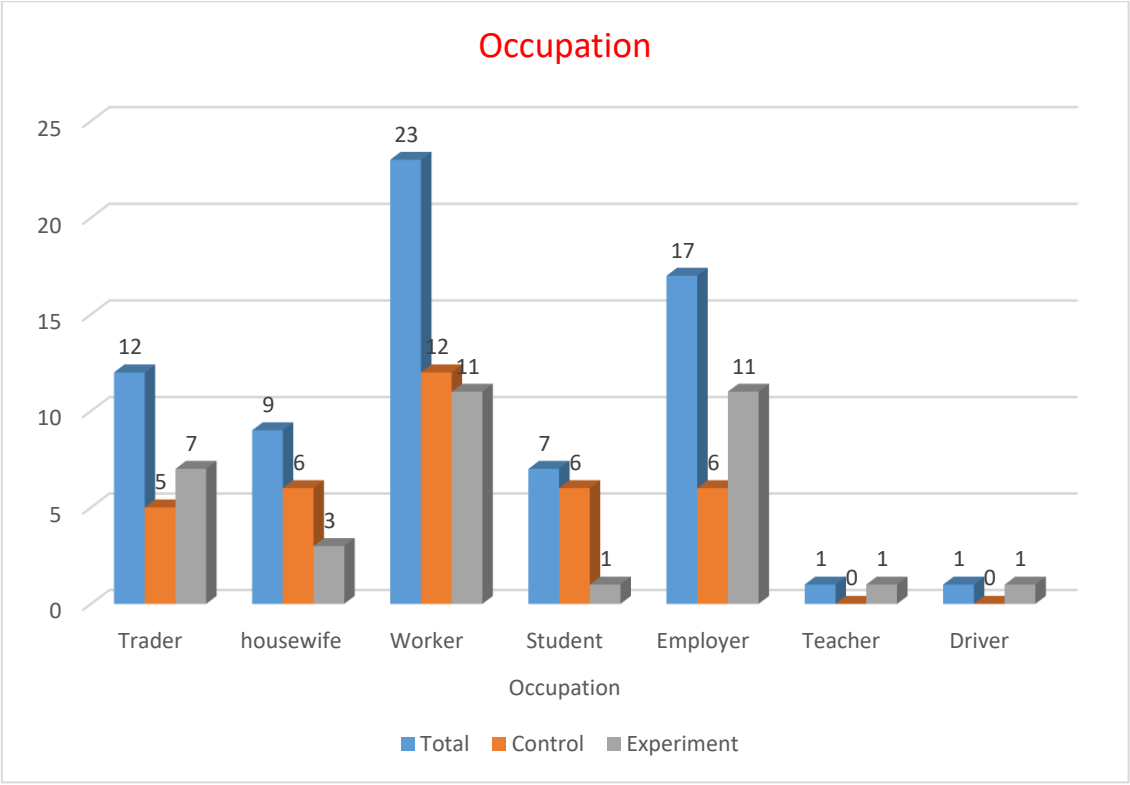


Figure 4.5 According to occupation

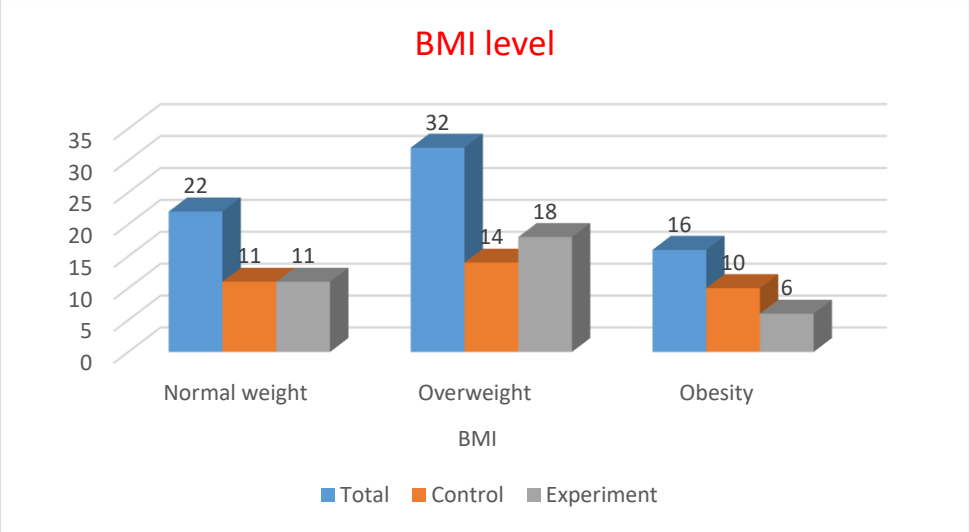


Figure 4.6 According to BMI level

4.1.3 Description of the participant's health history

The analysis revealed that the majority of the participants, 51 (72.9%), haven't had a past medical history. However, 60 (85.7%) of them have a past general surgical history. In addition, 40 (57.1%) of them have extra-articular fractures, and more than half of them, 41 (58.6%), were falling down, as seen in Table 4-2.

Table 4-2 Description of the participants' health history (N =70)

Variables		Total	Control	Experiment	Test statistics	*P*-value
Past medical history	No	51(72.9)	28(80.0)	23(65.7)	3.433	0.634
	Diabetes	4(5.7)	2(5.7)	2(5.7)		
	Hypertension	5(7.1)	1(2.9)	4(11.4)		
	DM, HTN,	7(10.0)	3(8.6)	4(11.4)		
	Heart problems and hypertension	2(2.9)	1(2.9)	1(2.9)		
	Heart problems	1(1.4)	0(0.0)	1(2.9)		
Past general surgical history	Yes	60(85.7)	29(82.9)	31(88.6)	0.467	0.495
	No	10(14.3)	6(17.1)	4(11.4)		
Past surgical fracture	Intra-articular fracture	30 (42.9)	15(42.9)	15 (42.9)		
	Extra-articular fracture	40(57.1)	20(57.1)	20(57.1)	0.00	1.0
History of trauma	Falling down	41(58.6)	20(57.1)	21(60.0)	1.224	0.542
	Bullet injury	20(28.6)	9(25.7)	11(31.4)		
	Road traffic accident	9(12.9)	6(17.1)	3(8.6)		

P. value significant at the 0.05 level

4.1.3 Characteristics of the study participants in the two groups

A chi-square analysis was conducted to evaluate whether there were any noteworthy disparities in socio-demographic data between the experimental and control groups. The findings indicated that there were no significant differences observed between the two groups, as presented in Table 4-1. Additionally, a chi-square test was conducted to examine if there were any significant differences in health history between the experimental and control groups. The results demonstrated no significant differences between the two groups, as shown in Table 4–2.

4.1.4 Characteristics of the study participants in the two groups according to pain level

The effect of CPM (continuous passive motion) on the prognosis of pain compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture

The differences in pain scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there was a significant difference in pain score mean between the experimental and control groups (P< 0.05). The mean pain scores of the experimental group (M = 1.9±SD 1.1) were lower than those of the control group (M = 2.6±SD 1.4), as seen in the following tables

Comparisons of the mean of the pain scores between the control and Experimental groups at post-test (N= 70)

Variable	Control	Experimental	t test	p. value
VAS	**M(SD)**	**M(SD)**		
	2.6(1.4)	1.9(1.1)	2.220	0.030*

P. value significant at the 0.05 level

Also, the analysis of pain level revealed that 3 (75.0%) have no pain in the experimental group while only 1 (25.0%) in the control group, as seen in Table 4-5.

Table 4-5. Description of Participants pain level (N =70)

Variables		Control n(%)	Experiment n(%)
Pain level	No pain	1 (25.0%)	3 (75.0%)
	Mild pain	27(48.2%)	27 (48.2%)
	Moderate pain	7(70.0%)	3(30.0%)

The analysis revealed that there was a significant difference in the mean pain scores between the pre- and post-tests in the experimental group (P< 0.05). The mean pain scores of the experimental group at the post-test (M = 1.0±SD 0.4) was lower than the pre-test (M = 5.7±SD 1.4), as seen in Table 4-6.

Table 4-6. Comparisons of the pain scores mean of the experimental group at pre and post-test (N= 35)

Variable	Pretest	Post-test	t test	p. value
VAS	M(SD)	M(SD)		
	5.7(1.4)	1.0(0.4)	23.198	0.001*

P. value significant at the 0.05 level

Also, the analysis revealed that there was a significant difference in the mean pain scores between the pre- and post-tests in the control group (P< 0.05). The mean pain scores of the control group at the post-test (M = 1.2±SD 0.5) was lower than the pre-test (M = 5.7±SD 1.6), as seen in Table 4-7.

Table 4-7. Comparisons of the pain scores mean of the control group at pre and post-test (N= 35)

Variable	Pretest	Post-test	t test	p. value
VAS	M(SD)	M(SD)		
	5.7(1.6)	1.2(0.5)	21.192	0.001*

P. value significant at the 0.05 level

The analysis of pain level using VAS revealed that 24 (49.0%) of control group and 25 (51.0%) of the experimental group have moderate pain. Also, 8 (47.1%) of the control group and 9 (52.9%) of the experimental group have severe pain, as seen in Table 4-8.

Table 4-8. Description of Participants pre -test pain level using VAS (N =70)

Variables		Total N(%)	Control n(%)	Experiment n(%)	Test statistics	*P*-value
Pain level	No pain (0)	0 (0.0)	0(0.0)	0 (0.0)	X^2= 1.079	0.583
	Mild pain (1-3)	4 (5.7)	3 (75.0)	1(25.0)		
	Moderate pain (4-9)	49(70.0)	24(49.0)	25(51.0)		
	Severe pain (7-9)	17(24.3)	8(47.1)	9(52.9)		

P. value significant at the 0.05 level

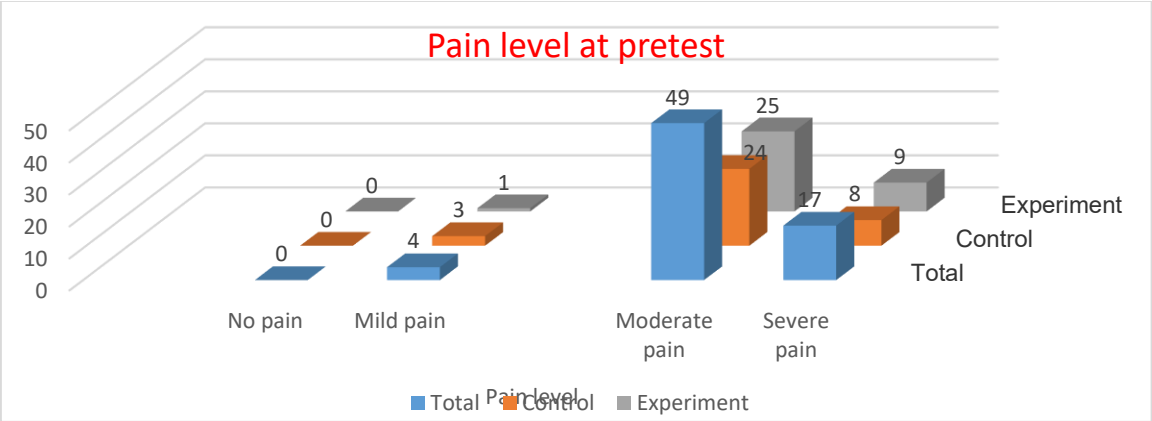


Figure 4.7 pain level at pretest

Table 4-8. Description of Participants post -test pain level using VAS (N =70)

Variables		Total N(%)	Control n(%)	Experiment n(%)	Test statistics	*P*-value
Pain level	No pain (0)	4 (%11)	1 (4 %)	3 (12%)	X^2= 1.000	0.004
	Mild pain (1-3)	54(77 %)	27 (77%)	27 (77%)		
	Moderate pain (4-9)	10 (14%)	7 (2%)	3 (8%)		
	Severe pain (7-9)	2 (2%)	1 (4 %)	1(4%)		

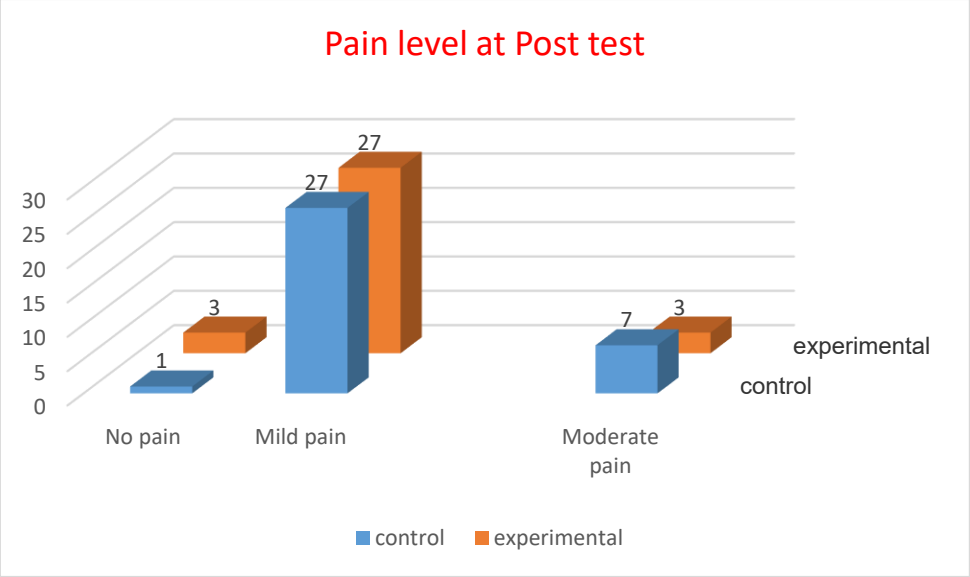


Figure 4.8 pain levels at post test

4.1.5 Outcomes of the study participants in the two groups

To compare the outcomes of the two groups at the post-test, the homogeneity of the two groups at the pre-test must be assessed. Therefore, the means of outcomes between the experimental and control groups were compared using an independent sample t-test, which is illustrated in Table 4-9

The first assumption of the t test was the normal distribution of the variables outcomes scores, which were assessed by a histogram, Kolmogorov-Smirnov, and Shapiro-Wilk tests of normality that indicated the outcomes variables scores were approximately normally distributed within the two groups (P> 0.05). The second assumption was Levene's test conducted to test the homogeneity of variances between the two groups ($p > 0.05$). This indicated no significant violation of the equal variance assumption. The third assumption is the existence of two mutually exclusive groups, the experimental and the control groups.

The effect of CPM (continuous passive motion) on the prognosis of functional activity in daily living compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture

Table 4-9 Comparison of the means of the outcomes scores between the control and experimental groups at pre-test (N=70)

Outcomes		**Control**	**Experimental**	**Levene's test**	**p. value**	**t test**	**p. value**
		M(SD)	**M(SD)**				
Functional ability according to oxford scale		39.1(7.9)	40.6(7.7)	0.027	0.870	0.793	0.431
VAS		5.7(1.6)	5.7(1.4)	0.036	0.851	0.001	0.99
Knee ROM	Flexion	84.0(9.7)	78.2(13.3)	5.894	0.053	2.070	0.055
	Extension	4.1(2.4)	5.1(2.3)	0.005	0.944	1.688	0.096
Muscle strength	Quadriceps	2.8(0.6)	2.7(0.6)	3.026	.086	1.186	0.240
	Hamstring	2.6(0.7)	2.5(0.6)	.242	.625	.189	0.851

P. value significant at the 0.05 level

The differences in functional activity of daily living scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there was a significant difference in the functional activity of daily living scores between the experimental and control groups ($P< 0.05$).

The mean functional activity of daily scores in the experimental group (M = 23.0±SD 6.4) was lower than that in the control group (M = 27.2±SD 7.9), as seen in Table 4-9.

Table 4-9 Comparisons of the functional ability of the experimental group at pre and post-test according to knee oxford scale

Functional activity	Pre test	Post test
	M(SD)	M(SD)
How would you describe the pain you usually have from your knee?	4.0 (0.7)	2.3 (0.7)
Have you had any trouble with washing and drying yourself (all over) because of your knee?	3.1 (0.8)	1.7 (0.6)
Have you had any trouble getting in and out of a car or using public transport because of your knee? (whichever you would tend to use)	3.7 (0.6)	2.1 (0.6)
For how long have you been able to walk before pain from your knee becomes severe? (with or without a stick)	3.1 (0.8)	1.7 (0.7)
After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?	3.4 (0.7)	2.1 (0.6)
Have you been limping when walking, because of your knee?	4.0 (1.0)	2.2 (0.8)
Could you kneel down and get up again afterwards?	2.7 (0.9)	1.5 (0.6)
Have you been troubled by pain from your knee in bed at night?	3.1 (1.1)	1.7 (0.7)
How much has pain from your knee interfered with your usual work (including housework)?	3.7 (0.9)	2.2 (0.7)
Have you felt that your knee might suddenly 'give way' or let you down?	2.9 (0.9)	1.5 (0.7)
Could you do the household shopping on your own?	3.2 (0.9)	1.7 (0.8)
Could you walk down one flight of stairs?	3.5 (0.7)	2.2 (0.5)
Functional activity of daily living	**40.6(7.7)**	**23.0(6.5)**

P. value significant at the 0.05 level

The analysis revealed that there was a significant difference in functional activity of daily living scores mean between pre- and post-test of the control group (P< 0.05). The mean functional activity of daily scores in the control group at the post-test (M = 27.2±SD 7.9) was lower than the pre-test (M = 39.1±SD 7.9), as seen in Table 4-10.

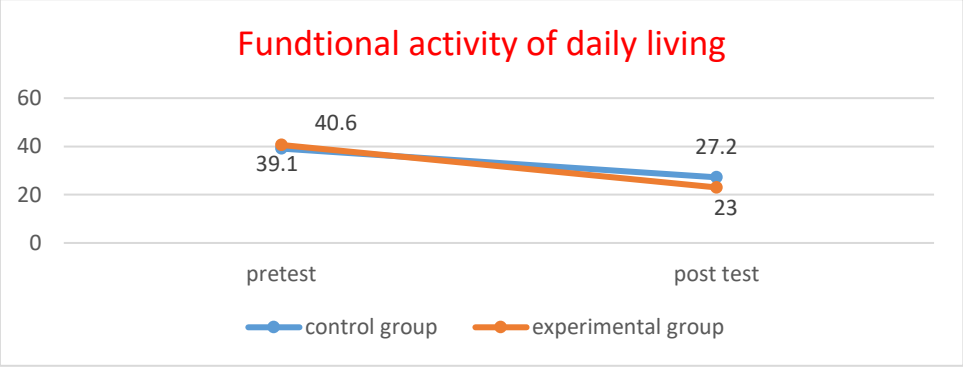


Figure 4.9 Functional activity of daily living

Table 4-10. The Functional activity of daily living of the control group was compared between the pre-test and post-test. (N= 35)

Functional activity	Pre test	Post test
	M(SD)	M(SD)
How would you describe the pain you usually have from your knee?	3.9 (0.7)	2.7 (0.7)
Have you had any trouble with washing and drying yourself (all over) because of your knee?	3.0 (0.7)	2.0 (0.7)
Have you had any trouble getting in and out of a car or using public transport because of your knee? (whichever you would tend to use)	3.6 (0.6)	2.7 (0.8)
For how long have you been able to walk before pain from your knee becomes severe? (with or without a stick)	2.9 (0.8)	2.0 (0.7)
After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?	3.1(0.7)	2.4 (0.7)
Have you been limping when walking, because of your knee?	3.9 (0.9)	2.7 (1.1)
Could you kneel down and get up again afterwards?	2.5 (0.9)	1.5 (0.7)
Have you been troubled by pain from your knee in bed at night?	3.0 (0.9)	2.1 (0.8)
How much has pain from your knee interfered with your usual work (including housework)?	3.7 (0.9)	2.7 (0.9)
Have you felt that your knee might suddenly 'give way' or let you down?	2.9 (0.8)	1.7 (0.7)
Could you do the household shopping on your own?	3.2 (1.0)	2.1 (1.0)
Could you walk down one flight of stairs?	3.3 (0.6)	2.4 (0.7)
Functional activity of daily living	**39.1(7.9)**	**27.2(7.9)**

While, the differences in functional activity of daily living scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

Table 4.11. Comparisons of the means of the functional activity of daily living scores between the control and Experimental groups at post-test (N= 70)

Functional activity	Control	Experimental
	M(SD)	M(SD)
How would you describe the pain you usually have from your knee?	2.7(0.7)	2.3(0.7)
Have you had any trouble with washing and drying yourself (all over) because of your knee?	2.0(0.7)	1.7(0.6)
Have you had any trouble getting in and out of a car or using public transport because of your knee? (whichever you would tend to use)	2.7(0.8)	2.1(0.6)
For how long have you been able to walk before pain from your knee becomes severe? (with or without a stick)	2.0(0.7)	1.7(0.7)
After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?	2.4(0.7)	2.1(0.6)
Have you been limping when walking, because of your knee?	2.7(1.1)	2.2(0.8)
Could you kneel down and get up again afterwards?	1.5(0.7)	1.5(0.6)
Have you been troubled by pain from your knee in bed at night?	2.1(0.8)	1.7(0.7)
How much has pain from your knee interfered with your usual work (including housework)?	2.7(0.9)	2.2(0.7)
Have you felt that your knee might suddenly 'give way' or let you down?	1.7(0.7)	1.5(0.7)
Could you do the household shopping on your own?	2.1(1.0)	1.7(0.8)
Could you walk down one flight of stairs?	2.4(0.7)	2.2(0.5)
Functional activity of daily living	**27.2(7.9)**	**23.0(6.5)**

The analysis revealed that there was a significant difference in the functional activity of daily living scores between the experimental and control groups ($P< 0.05$). The mean functional activity of daily scores in the experimental group ($M = 23.0 \pm SD\ 6.4$) was lower than that in the control group ($M = 27.2 \pm SD\ 7.9$), as seen in Table 4-11.

The effect of CPM (continuous passive motion) on the prognosis of knee range of motion compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture

The differences in range of motion scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there was a significant difference in flexion scores between the experimental and control groups (P< 0.05). The mean flexion scores of the experimental group (M = 117.4±SD 9.7) was better than those of the control group (M = 112.1±SD 10.5). Also, the mean extension scores of the experimental group (M=1.3±SD 1.1) was lower than those of the control group (M=1.5±SD 1.6) but not statistically significant (p> 0.05), as seen in Table 4-12.

Table 4.12. Comparisons of the means of range of motion scores between the control and Experimental groups at post-test (N= 70)

Variable		**Control**	**Experimental**	**t test**	**p. value**
Knee ROM		**M(SD)**	**M(SD)**		
	Flexion	112.1(10.5)	117.4(9.7)	-2.155	0.035*
	Extension	1.5(1.6)	1.3(1.1)	.515	0.608

P. value significant at the 0.05 level

The analysis revealed that there was a significant difference in knee range of motion scores between the pre- and post-tests in the experimental group (P< 0.05). The mean flexion scores of the experimental group at the post-test (M = 117.4±SD 9.7) was better than the pre-test (M = 78.2±SD 13.3). Also, the mean of extension scores of the post-test (M = 1.3±SD 1.1) was significantly better than the pre-test (M = 5.1±SD 2.3), as seen in Table 4-13.

Table 4-13. Comparisons of the range of motion scores mean of the experimental group at pre and post-test (N= 35)

Variable		**Pretest**	**Post-test**	**t test**	**p. value**
Knee ROM		**M(SD)**	**M(SD)**		
	Flexion	78.2(13.3)	117.4(9.7)	19.234	0.001*
	Extension	5.1(2.3)	1.3(1.1)	14.530	0.001*

P. value significant at the 0.05 level

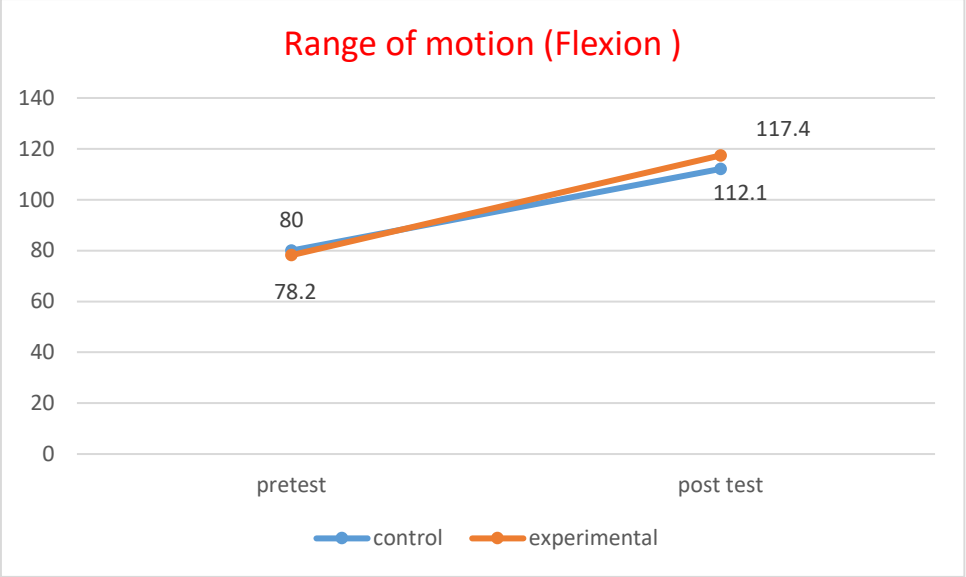


Figure 4.10 ROM (Flexion)

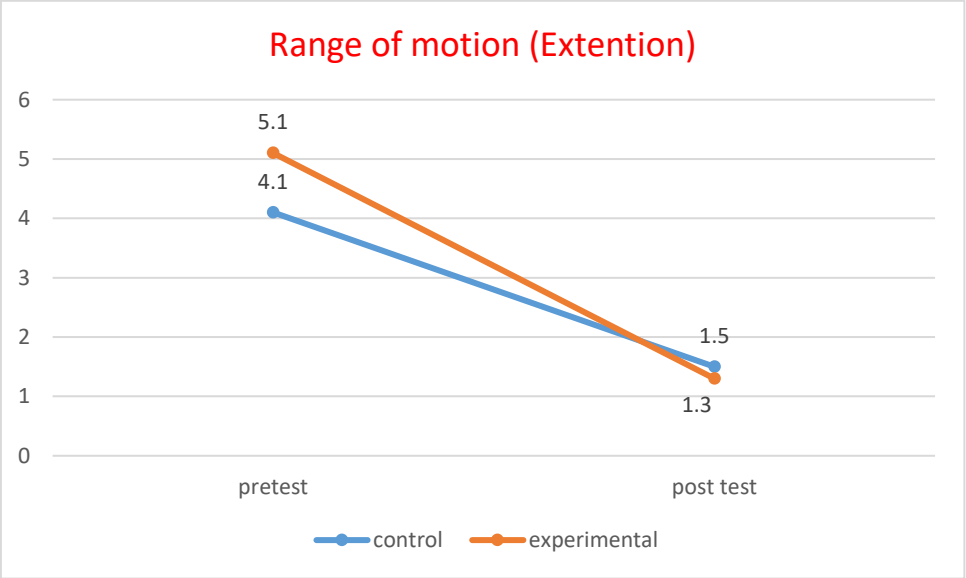


Figure 4.11 ROM (extension)

The analysis revealed that there was a significant difference in knee range of motion scores between the pre- and post-tests in the control group (P< 0.05). The mean of flexion scores at the post-test (M = 112.1±SD 10.5) was better than the pre-test (M = 84.0±SD 9.7). Also, the mean of extension scores of the post-test (M = 1.5±SD 1.6) was significantly better than the pre-test (M = 4.1±SD 2.4), as seen in Table 4-14.

Table 4-14. Comparisons of the range of motion scores mean of the control group at pre and post-test (N= 35)

Variable		Pretest	Post-test	t test	p. value
Knee ROM		**M(SD)**	**M(SD)**		
	Flexion	84.0(9.7)	112.1(10.5)	24.163	0.001*
	Extension	4.1(2.4)	1.5(1.6)	14.163	0.001*

P. value significant at the 0.05 level

The effect of CPM (continuous passive motion) on the prognosis of knee muscle strength compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture

The differences in muscle strength scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there are no significant differences in muscle strength scores (quadriceps and hamstring) between the experimental and control groups (P> 0.05), as seen in Table 4-15.

Table 4.15 Comparisons of the means of the knee muscle strength scores between the control and Experimental groups at post-test (N= 70)

Variable		Control	Experimental	t test	p. value
		M(SD)	**M(SD)**		
Muscle strength	Quadriceps	4.1(.7)	4.3(0.6)	-1.121	0.266
	Hamstring	3.9(0.6)	4.1(0.6)	-1.465	0.147

P. value significant at the 0.05 level

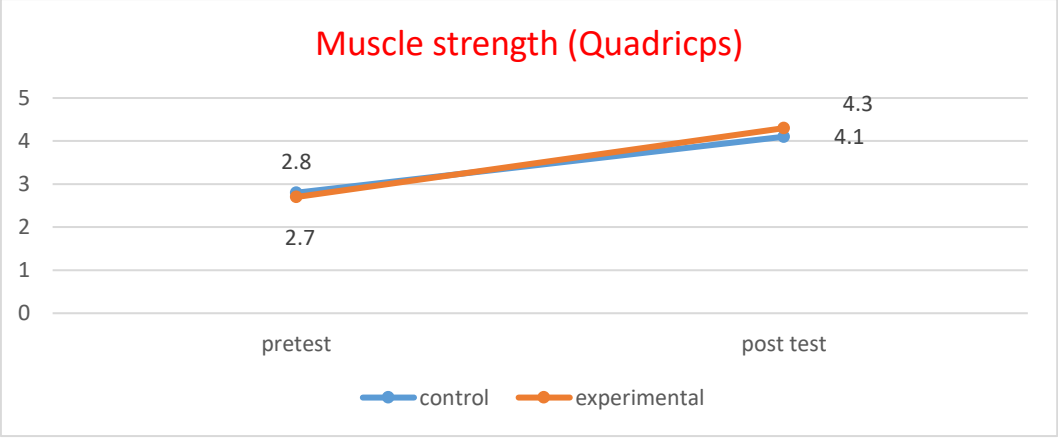


Figure 4.12 Muscle Strrengh (quadricps)

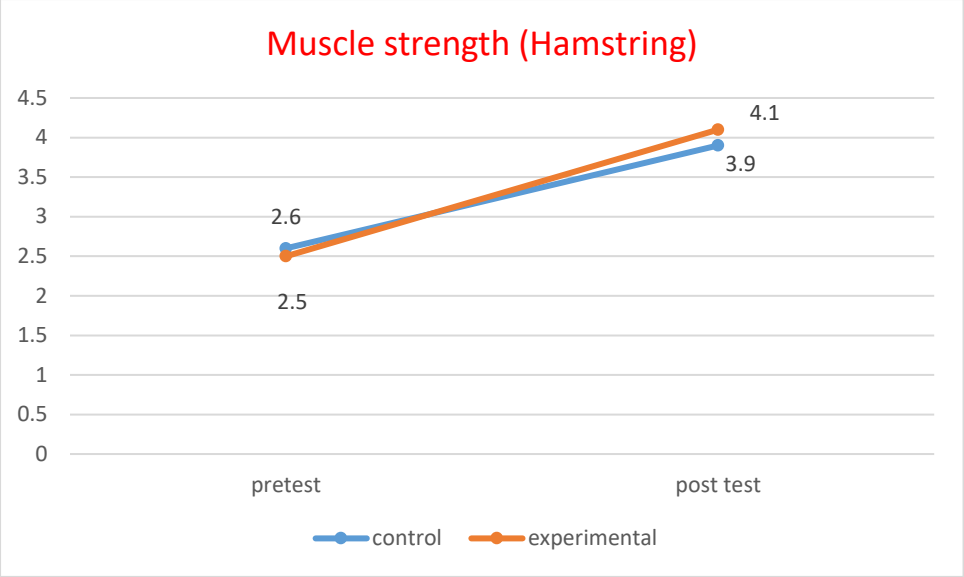


Figure 4.13 Muscle Strrengh(hamstring)

The analysis revealed that there was a significant difference in muscle strength (quadriceps and hamstring) scores between the pre- and post-tests of the experimental group (P< 0.05). The mean of quadriceps muscle scores at the post-test (M = 4.3±SD 0.6) was better than the pre-test (M = 2.7±SD 0.6). Also, the mean hamstring muscle scores of the post-test (M = 4.1±SD 0.6) was improved significantly compared to the pre-test (M = 2.5±SD 0.6), as seen in Table 4-16.

Table 4-16. Comparisons of the muscle strength scores mean of the experimental group at pre and post-test (N= 35)

Variable		**Pretest**	**Post-test**	**t test**	**p. value**
Muscle strength		**M(SD)**	**M(SD)**		
	Quadriceps	2.7(0.6)	4.3(0.6)	16.581	0.001*
	Hamstring	2.5(0.6)	4.1(0.6)	19.044	0.001*

The significance of the p-value is observed at the 0.05 level.

The analysis revealed that there was a significant difference in muscle strength scores between the pre- and post-tests in the control group (P< 0.05). The mean of quadriceps muscle scores at the post-test (M = 4.1±SD 0.7) was better than the pre-test (M = 2.8±SD 0.6). Also, the mean hamstring muscle scores of the post-test (M = 3.9±SD 0.6) was improved significantly compared to the pre-test (M = 2.6±SD 0.7), as seen in Table 4-17.

Table 4-17. Comparisons of the muscle strength scores mean of the control group at pre and post-test (N= 35)

Variable		Pretest	Post-test	t test	p. value
Muscle strength		**M(SD)**	**M(SD)**		
	Quadriceps	2.8(0.6)	4.1(0.7)	16.508	0.001*
	Hamstring	2.6(0.7)	3.9(0.6)	16.550	0.001*

The significance of the p-value is observed at the 0.05 level.

Research question Five: What is the effect of CPM (continuous passive motion) on the prognosis of knee circumference compared with conventional physiotherapy treatment on patients with post-traumatic knee fracture?

The differences in knee circumference scores between the experimental and control groups at the post-test and between the groups themselves pre- and post-test were examined. These differences were examined by a paired t-test and an independent t-test.

The analysis revealed that there are no significant differences in knee circumference scores (above knee, knee, and below knee) between the experimental and control groups (P> 0.05), as seen in Table 4-18.

Table 4.18. Comparisons of the means of the knee circumference scores between the control and Experimental groups at post-test (N= 70)

Variable		Control	Experimental	t test	p. value
		M(SD)	**M(SD)**		
Knee circumference	Above knee -5 cm	40.7(1.8)	41.2(1.6)	-1.182	0.241
	Knee (Mid Patella Level)	39.2(1.6)	39.5(1.7)	-.839	0.404
	Below knee -5 cm	37.1(2.1)	37.4(2.3)	-.450	0.654

The significance of the p-value is observed at the 0.05 level.

The analysis shown that there were significant difference in knee circumference scores (above knee, knee, and below knee) between the pre- and post-tests of the experimental group (P< 0.05). The mean of above-knee circumference scores at the post-test (M = 41.2±SD 1.6) was better than the pre-test (M = 41.9±SD 1.8). The mean knee circumference scores of the post-test (M = 39.5±SD 1.7) was improved significantly compared to the pre-test (M = 40.0±SD 1.6). Also, the mean of below knee circumference scores of the post-test (M = 37.4±SD 2.3) was significantly better than the pre-test (M = 37.8±SD 2.3), as seen in Table 4-19.

Table 4-19. Comparisons of the knee circumference scores mean of the experimental group at pre and post-test (N= 35)

Variable		Pretest	Post-test	t test	p. value
Knee circumference		**M(SD)**	**M(SD)**		
	Above knee	41.9 (1.8)	41.2(1.6)	8.028	0.001*
	Knee	40.0(1.6)	39.5(1.7)	6.671	0.001*
	Below knee	37.8(2.3)	37.4(2.3)	7.381	0.001*

The significance of the p-value is observed at the 0.05 level.

The analysis shown that there were significant difference in knee circumference scores (above knee, knee, and below knee) between the pre- and post-tests of the control group (P< 0.05). The mean of above-knee circumference scores at the post-test (M = 40.7±SD 1.8) was better than the pre-test (M = 41.2±SD 1.7). The mean knee circumference scores of the post-test (M = 39.2±SD 1.6) improved significantly compared to the pre-test (M = 39.7±SD 1.7). Also, the mean below knee circumference scores of the post-test (M = 37.1±SD 2.1) was significantly improved than the pre-test (M = 37.6±SD 2.3), as seen in Table 4-20.

Table 4-20. Comparisons of the knee circumference scores mean of the control group at pre and post-test (N= 35)

Variable		Pretest	Post-test	t test	p. value
Knee circumference		**M(SD)**	**M(SD)**		
	Above knee	41.2(1.7)	40.7(1.8)	7.306	0.001*
	Knee	39.7(1.7)	39.2(1.6)	7.294	0.001*
	Below knee	37.6(2.3)	37.1(2.1)	7.350	0.001*

The significance of the p-value is observed at the 0.05 level.

The relationship between functional activity mean scores and participants body mass index levels at pre-test and post-test

The analysis revealed that there were no significant differences in functional activity and BMI levels in both groups (P> 0.05), as seen in Table 4-21.

Table 4-21. Differences between functional activity mean scores and participants BMI levels at pre-test (N=70)

		Control			Experiment		
Variables		**M(SD)**	**ANOVA**	***P*-value**	**M(SD)**	**ANOVA**	***P*-value**
BMI	Normal weight	41.1(8.7)	.484	.621	7.7(2.3)	.514	.603
	Overweight	38.0(7.7)			8.1(1.9)		
	Obesity	38.6(8.0)			7.0(2.9)		

The significance of the p-value is observed at the 0.05 level.

Also, the analysis revealed that there were no significant differences in functional activity and BMI levels in both groups (P> 0.05), as seen in Table 4-22.

Table 4-22. Differences between functional activity mean scores and participants BMI levels at post-test (N=70)

		Control			Experiment		
Variables		**M(SD)**	**ANOVA**	***P*-value**	**M(SD)**	**ANOVA**	***P*-value**
BMI	Normal weight	29.5(8.4)	.654	.527	8.5(2.6)	1.078	.352
	Over weight	26.1(7.6)			5.7(1.3)		
	Obesity	26.1(8.1)			3.9(1.6)		

The significance of the p-value is observed at the 0.05 level.

The relationship between functional activity mean scores and health history in terms of past surgical fracture and history of trauma at pre-test and post-test

The analysis shown that there were no significant difference in functional activity between participants' past surgical fracture and history of trauma in the both groups at pre-test (P> 0.05), as seen in Table 4-23.

Table 4-23. Differences between functional activity mean scores and participants health history in terms of past surgical fracture and history of trauma at pre-test (N=70)

		Control			Experiment		
Variable		**M(SD)**	**test**	***P*-value**	**M(SD)**	**Test**	***P*-value**
Past surgical fracture	Intra-articular fracture	41.6(9.5)	t=1.529	0.140	42.8(6.0)	t=1.464	0.153
	Extra-articular fracture	37.3(6.2)			39.0(8.6)		
History of trauma	Falling down	38.4(8.9)	F=0.609	0.550	7.6(1.7)	F=1.676	.203
	Bullet Injury	41.7(6.6)			7.1(2.1)		
	Road Traffic Accident	37.8(6.5)			9.1(5.2)		

The significance of the p-value is observed at the 0.05 level.

However, the analysis revealed that there was a significant difference in functional activity and participants' past surgical fracture in the control group at post-test (P< 0.05), as seen in Table 4-23.

Table 4-24. Differences between functional activity mean scores and participants health history in terms of past surgical fracture and history of trauma at post-test (N=70)

		Control			Experiment		
Variable		**M(SD)**	**test**	***P*-value**	**M(SD)**	**Test**	***P*-value**
Past surgical fracture	Intra-articular fracture	30.4(8.9)	t=2.096	0.047*	24.7(7.0)	t=1.414	0.167
	Extra-articular fracture	24.8(6.2)			21.7(5.9)		
History of trauma	Falling down	26.5(8.5)	F=.735	.487	6.1(1.3)	F=.737	.486
	Bullet Injury	29.9(7.5)			7.5(2.3)		
	Road Traffic Accident	25.5(6.4)			5.7(3.3)		

The significance of the p-value is observed at the 0.05 level.

The relationship between pain means scores and health history in terms of past surgical fracture and history of trauma at pre-test and post-test

The analysis revealed that there was a significant difference in pain means scores between participants' past surgical fracture in the control group at pre- test (P< 0.05). The mean of pain (M= 5.2± 1.2) in the extra-articular fracture was lower than those in the intra-articular fracture (M=6.5±1.8), as seen in Table 4-25.

Table 4-25. Differences between pain mean scores and participants health history in terms of past surgical fracture and history of trauma at pre-test (N=70)

		Control			Experiment		
Variable		**M(SD)**	**Test**	***P*-value**	**M(SD)**	**Test**	***P*-value**
Past surgical fracture	Intra-articular fracture	6.5(1.8)	t=2.64	0.013	6.0(1.3)	t=1.027	0.312
	Extra-articular fracture	5.2(1.2)			5.5(1.5)		
History of trauma	Falling down	5.8(1.7)	F=.428	.655	5.4(1.4)	F= 1.094	.347
	Bullet Injury	5.9(1.5)			6.1(1.4)		
	Road Traffic Accident	5.2(1.3)			6.3(1.5)		

The significance of the p-value is observed at the 0.05 level.

Analysis revealed that there was a significant difference in pain means scores between participants' past surgical fracture in the control group at post- test (P< 0.05). The mean of pain (M= 2.1± 1.1) in the extra-articular fracture was better than those in the intra-articular fracture (M=3.3±1.4), as seen in Table 4-26.

Table 4-26. Differences between pain mean scores and participants health history in terms of past surgical fracture and history of trauma at post-test (N=70)

		Control			Experiment		
Variable		**M(SD)**	**Test**	***P*-value**	**M(SD)**	**Test**	***P*-value**
Past surgical fracture	Intra-articular fracture	3.3(1.4)	t=3.106	0.004*	2.3(0.8)	t=1.867	0.071
	Extra-articular fracture	2.1(1.1)			1.7(1.2)		
History of trauma	Falling down	2.7(1.5)	F=.167	.847	1.8(1.1)	F=.794	.461
	Bullet Injury	2.6(1.4)			2.0(1.1)		
	Road Traffic Accident	2.3(1.1)			2.7(1.2)		

The significance of the p-value is observed at the 0.05 level.

The relationship between range of motion mean scores in terms of flexion and extension and age of the participants at pre-test and post-test

Analysis shown that there were no significant difference in ROM (flexion and extension) mean score and participants' age in the both groups at pre-test (P> 0.05), as seen in Table 4-27.

Table 4-27. Differences between range of motion scores and participants age at pre-test (N=70)

		Control			Experiment		
AGE		**M(SD)**	**ANOVA**	***P*-value**	**M(SD)**	**ANOVA**	***P*-value**
Flexion	less than 20 years	95.0(7.0)	1.487	.237	0(0.0)	.796	.460
	20-29 years	82.2(9.1)			78.3(5.1)		
	30-39 years	81.9(10.8)			74.5(3.3)		
	40 years and above	86.8(8.1)			81.2(3.2)		
Extension	less than 20 years	3.0(0.0)	1.538	.224	0(0.0)	2.064	.143
	20-29 years	5.2(3.0)			5.6(2.9		
	30-39 years	3.2(2.0)			5.6(2.1		
	40 years and above	4.3(2.1)			4.1(1.4)		

The significance of the p-value is observed at the 0.05 level.

Also, the analysis revealed that there were no significant differences in range of motion (flexion and extension) mean scores and participants'' age in the both groups at post-test (P> 0.05), as seen in Table 4-28.

Table 4-28. Differences between range of motion scores and participants' age at post-test (N=70)

		Control			Experiment		
AGE		**M(SD)**	**F**	***P*-value**	**M(SD)**	**F**	***P*-value**
Flexion	less than 20 years	121.0(12.7)	1.071	.375	0 (0.0)	.550	.582
	20-29 years	108.3(9.7)			115.0(13.1)		
	30-39 years	113.7(10.9)			117.5(6.6)		
	40 years and above	112.7(10.6)			119.2(9.0)		
Extension	less than 20 years	0.0(0.0)	2.107	.120	0(0.0)	.526	.596
	20-29 years	2.3(2.1)			1.5(1.4)		
	30-39 years	0.9(1.1)			1.3(1.0)		
	40 years and above	1.6(1.5)			1.1(0.9)		

The significance of the p-value is observed at the 0.05 level.

The relationship differences between muscle strength mean scores (quadriceps and hamstring muscles) and age of the participants at pre-test and post-test

The analysis shown that there were no significant difference in muscle strength (quadriceps and hamstring muscles) mean scores and participants' age in the both groups at pre-test (P> 0.05), as seen in Table 4-28.

Table 4-29. Differences between muscle strength scores and participants age at pre-test (N=70)

		Control			Experiment		
Muscle strength	**AGE**	**M(SD)**	**F**	***P*-value**	**M(SD)**	**F**	***P*-value**
Quadriceps	less than 20 years	3.5(0.7)	1.004	.404	0(0.0)	.360	.701
	20-29 years	2.8(0.6)			2.6(0.8)		
	30-39 years	2.8(0.4)			2.5(0.5)		
	40 years and above	2.8(0.7)			2.8(0.6)		
Hamstring	less than 20 years	3.5(0.7)	2.411	.086	0(0.0)	.197	.822
	20-29 years	2.6(0.7)			2.5(0.7)		
	30-39 years	2.3(0.5)			2.5(0.5)		
	40 years and above	2.7(0.7)			2.6(0.7)		

The significance of the p-value is observed at the 0.05 level.

Also, the analysis shown that there were no significant difference in muscle strength (quadriceps and hamstring muscles) mean score and participants' age in the both groups at post-test (P> 0.05), as seen in Table 4-29.

Table 4-30. Differences between muscle strength scores and partcipants age at pre-test (N=70)

		Control			Experiment		
AGE		**M(SD)**	**F**	***P*-value**	**M(SD)**	**F**	***P*-value**
quadriceps	less than 20 years	5.0(0.0)	1.554	.220	0(0.0)	1.284	.291
	20-29 years	3.9(0.7)			4.1(0.7)		
	30-39 years	4.2(0.6)			4.4(0.5)		
	40 years and above	4.2(0.8)			4.5(0.5)		
Hamstring	less than 20 years	5.0(0.0)	2.832	.054	0(0.0)	.550	.582
	20-29 years	3.8(0.6)			4.0(0.8)		
	30-39 years	3.8(0.4)			4.2(0.4)		
	40 years and above	4.0(0.7)			4.2(0.4)		

The significance of the p-value is observed at the 0.05 level.

4.2 Results Discussion

The present study indicated that the functional activity of daily living was better in the CPM group on early post- knee traumatic patients than those who received normal or standardized physical therapy care. Also, the current study indicated that the pain was improved in the CPM group more than in those who received normal or standardized physical therapy care.

When comparing (CPM) vs. traditional physiotherapy on pain prognosis in participants with post-traumatic knee fracture at the post-test, the experimental group had a significant difference in mean pain scores (M = 1.9 SD 1.1) over the control group (M = 2.6 SD 1.4), highlighting the efficiency of CPM in pain reduction. Notably, a larger number of individuals in the experimental group (75.0%) reported no discomfort, highlighting CPM's potential for pain relief. Both groups showed significant decreases in pain ratings from pre- to post-test, with the experimental group demonstrating a greater reduction in pain scores (from 5.7 SD 1.4 to 1.0 SD 0.4) than the control group (from 5.7 SD 1.6 to 1.2 SD 0.5). These data show the positive effect of CPM on pain management Apart from that this study found that CPM considerably reduced patients' pain levels, which was consistent with our findings(Wright et al., 2008). Our finding supported by of this study results show The Knee Society Score (KSS1) was evaluated in two groups CPM group than the non-CPM group, with the findings given as mean standard deviation. The pre-treatment mean pain points in the initial group were 38.8 11.0, and after therapy, they fell dramatically to 30.7 12.1 (p = 0.008). This demonstrates a significant reduction in pain points following therapy in the first group. Similarly, the pre-treatment mean pain points in the second group were 44.8 7.0. There was a considerable reduction after therapy, with post-treatment mean pain points at 36.7 12.1 (p = 0.004). These data indicate that both groups saw considerable reduction in pain points following therapy, with the second group experiencing a significant drop despite having greater beginning pain points(Christiane Kabst et al., 2022).

Furthermore ,the result shows that there is a significant difference in mean functional activity of daily living ratings between the experimental and control groups (p = 0.018). The experimental group, in particular, had a lower mean score (23.06.5) than the control group (27.27.9). This shows that individuals who received CPM treatment had better functional results. The comparisons of pre-and post-test functional activity within the experimental group show a significant improvement. Participants reported significantly less discomfort (p = 0.001*). In Contrast, the control group had less improvement. This study found that CPM significantly decreased patients' which was consistent with our findings.

Another fact that cannot be ignored is that after 6 weeks, all patients progressed from partial to full weight-bearing exercise. Weight-bearing following knee surgery can appropriately stimulate knee healing, reduce discomfort, and enhance activity level, according to a review of research(Howard, Mattacola, Romine, & Lattermann, 2010).sane our results Oxford Knee Score (OKS4): Before therapy, the two groups had scores of 28.0 9.1, and 39.3 6.3, respectively. With a p-value of 0.207, the difference is statistically significant. A Prospective Randomized Controlled Study Continuous Passive Movement Improves with Prolonged Application showed significantly better results of the CPM group than the non-CPM group (C. Kabst et al., 2022).

According to the efficacy of CPM on the prognosis of knee ROM compared with conventional physiotherapy management on patients with post-traumatic knee fracture , the data reveals the analysis of the pre-test and post-test, considering both the experimental and control groups. showed substantial improvements in knee range of motion scores. There was a significant difference in knee range of motion scores in the experimental group, with a p-value less than 0.05. The mean flexion scores in the post-test (M = 117.4SD 9.7) were significantly higher than those at the pre-test (M = 78.2SD 13.3). Similarly, the mean **extension s**cores in the post-test (M = 1.3SD 1.1) improved significantly when compared to the pre-test (M = 5.1SD 2.3), with p-values less than 0.001.as the same results the CPM group had a significant increase in ROM, extension, and flexion compared with the non-CPM group and CPM therapy led to decreased joint stiffness and complications(D. M. Knapik et al., 2013; O'Driscoll, Kumar, & Salter, 1983)our results supported by as the similar our finding The CPM group also demonstrated a significant rise in ROM when compared to the non-CPM group (122:4 13:2 ° vs. 113:4 17:1 °, p = 0:040). The non-com group appeared to have considerably less knee flexion than the CPM group (non-CPM group vs. CPM group; 116:7 14:6° vs. 124:8 11:6°; p = 0:032). CPM patients' extension (2:73:6°) was only marginally better than that of the non-CPM group (3:34:5°) (p = 0:633)(Christiane Kabst et al., 2022).

Moreover, when comparing the effect of CPM on the prognosis of knee muscle strength compared with conventional physiotherapy management on patients with post-traumatic knee fracture. The results show that there was no statistically significant difference between the experimental and control groups (p = 0.266 at Post-Test for Quadriceps Muscle Strength. While for Hamstring Muscle strength: There was no statistically significant difference between the experimental and control groups (p = 0.147).

Further, Within the Experimental Group Both quadriceps and hamstring muscular strength improved significantly from pre-test to post-test (p 0.001). While, Within the Control Group Both quadriceps and hamstring muscular strength improved significantly from pre-test to post-test (p 0.001). Compare with the findings of previous studies CPM has the potential to limit muscle atrophy (Dhert, O'Driscoll, Van Royen, & Salter, 1988; Derrick M Knapik et al., 2013; Okamoto, Atsuta, & Shimazaki, 1999).Corresponding of our finding this study included ten patients who were separated into two groups: CPM therapy plus dryland walking exercise (CWD) and CPM plus aqua walking exercise (CAW).aims of this study Effect of aqua walking exercise on knee joint angles, muscular strength, The ROM in knee flexion showed a relationship between the two groups. When compared to CWD, CAW demonstrated a considerable increase in knee flexion angle. Strength on the knee flexors also showed a relationship between the two groups(Yang, Seo, & Kim, 2021).

Also , the findings indicate that there are statistically significant changes in knee circumference from pre-test to the post-test in the experimental group for all three variables (above knee, knee, and below knee p-value 0.001 same our finding in this study Theory and clinical use of continuous passive motion (CPM) show swelling that limits the full motion in (CPM)(O Driscoll & Giori, 2000).

Moreover, the results revealed that there were no significant differences in functional activity and BMI levels in both groups p value ($P > 0.05$).

The investigation exposed that there were no significant difference in functional activity among participants' past surgical fracture (fracture Intra-articular fracture Extra-articular fracture) and history of trauma (Falling down, Bullet Injury and Road Traffic Accident) at the post-test, the p-value for the difference in mean functional activity score between the control and experimental groups for participants with a history of intra-articular fracture is p value 0.047 that mean the pain was higher in the control group than in the experimental group according past surgical fracture (Intra-articular) .

Furthermore, at the pre-test, there were no significant differences in mean range of motion (flexion and extension) scores or participant age in either group ($P>0.05$). At the post-test, there were no significant differences in mean range of motion (flexion and extension) scores or participant age in either group ($P>0.05$).

Based on the analysis, it was found that there were no significant variations in the mean scores of muscle strength (quadriceps and hamstring muscles) and the age of the participants in both

groups during the pre-test., the analysis revealed that there were no significant differences in muscle strength (quadriceps and hamstring muscles) mean scores and participants' age in the both groups at post-test supported by randomly assigning 210 patients to two groups: 102 in the CPM group, who got regular rehabilitation therapy in addition to the CPM application, and 108 in the no-CPM group. The patients' mean age showed a non-statistically significant difference(Gil-González et al., 2022b).

4.3 Strength and limitation of the study:

Strength:

- The study used a randomized controlled trial (RCT) methodology, which is considered the gold standard in clinical research. This thorough technique reduces the possibility of bias and increases the reliability of the findings.
- The study addresses gaps in the current research since it is one of the few, if not the only, studies done in Palestine to evaluate the efficacy of a passive motion device to standard therapies for knee stiffness after accidents. This uniqueness adds significantly to the study's conclusions.
- Similar Sample: Because the study focused on a young age group with similar features, the intervention's effects on knee stiffness could be investigated in a more controlled manner.
- Potential for Future Research: The study's findings provide an ideal platform for future research on post-injury knee fracture.

4.3 Study Limitations

- This study was conducted only in Rafidia Governmental Hospital, and there were no other hospitals or centers. However, the place was convenient,accessible to all patients.
- The number of males was much greater than the number of females in this study although the knee injuries in more prevalent in male than female.
- Long-Term Follow-Up: There was no long-term follow-up period in the trial to assess the sustainability of the intervention's effects. This limitation prevents judgments concerning the passive motion device's long-term usefulness in maintaining knee stiffness improvements.

Chapter Five

5.1Conclusions

5.2 Recommendations

Chapter Five

5.1 Conclusion

- ❖ When compared to traditional physiotherapy, CPM revealed considerably higher functional activity of daily living according to Oxford knee score (OKS).
- ❖ CPM considerably reduced pain as compared to traditional physiotherapy.
- ❖ When compared to traditional physiotherapy, CPM revealed considerably better gains in flexion and extension ROM.
- ❖ When likened to the control group, the CPM group displayed considerably higher functional activity of daily living , demonstrating that CPM can successfully improve patients' capacity to complete everyday chores. This increase in functional activity is most likely related to the higher ROM and pain relief associated with CPM therapy.
- ❖ CPM was also found to be an effective pain management method, with the CPM group having much less pain than the control group. This pain reduction is most likely due to CPM's mild and continuous movement, which helps to minimize muscular spasms.

5.2 Recommendations.

✓ Recommendations for healthcare providers/ Physiotherapists:

- ❖ It is essential to increase the knowledge among physicians, orthopedics and physiotherapists about CPM use and its evidence-based results, in particular post Knee fracture injuries.

- ❖ CPM can be used as a main and useful technique for individuals suffering from post-traumatic knee stiffness. The study's findings clearly show that CPM improves functional activity, reduces discomfort, and improves knee range of motion (ROM). Incorporating CPM into the early stages of treatment can improve patient outcomes as well as reduce recovery time.

- Early implementation of the right moment of CPM is essential to maximize its benefits. It is critical to begin CPM treatment as soon as possible after an accident to avoid the development of chronic knee stiffness and to promote maximum functional recovery. Early management allows for knee joint early movement, which assistances prevent the formation of scar tissue and adhesions, which lead to stiffness.
- Combining CPM with other physiotherapy techniques is much more successful when comparing to use it stand-alone treatment; as coupled with other rehabilitation therapies such as home exercises might have a beneficial impact, addressing functional limits as well as pain management.

✓ Recommendations for the researchers:

- More studies are wanted to determine the best duration and intensity of CPM therapy. Also, more research is needed to Identify the optimal treatment parameters which can assist in tailoring CPM treatments to specific needs of patients and maximizing their effectiveness.
- Consistent protocols are needed which may provide healthcare practitioners clear instructions, ensuring that patients receive CPM therapy in a safe, effective, and similar manner.
- More comparative clinical investigations to other post-traumatic knee stiffness therapies are required to assess its relative efficacy and determine the most successful options for treatment. Such comparison investigations may shed light on the purpose of CPM in the treatment of knee stiffness following traumatic event.
- Long-term follow-up studies are required to assess the environmental sustainability of the advantages achieved with CPM therapy. Long-term outcomes of CPM patients can give useful information on the ongoing effectiveness of its advantages and its impact on long-term patient function.

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Appendixes

Appendix 1: Data collection sheet

The Effectiveness of CPM Device on Pain and ROM among Patients with Knee Stiffness post Traumatic comparative Experimental Study

فاعليه جهاز الحركات القصريه للمرضى الذين يعانون من محدوديه الحركيه في مفصل الركبه بعد الإصابه

المشارك | المشاركه الكريمه:

الدراسة تخص رسالة الماجستير للطالب قيس صالح من دائرة العلاج الطبيعي في جامعة القدس والتي تهدف الى استخدام جهاز الحركات القصريه للمرضى الذين يعانون محدوديه في حركه مفصل الركبه بعد التعرض للإصابه.

المشاركه طوعيه في الدراسه. وتم ايضاح جميع الاستفسارات عن طبيعه الدراسه ، علما انها بهدف البحث العلمي فقط .

Participant Name: _____

Participant Code: _____

Date of Signature: _____

Demographic data	
▪ Clinic Name:	
▪ Name:	
▪ Gender:	male ☐ Female ☐
▪ Age:	
▪ Level of education:	
▪ Marital status:	single ☐ married ☐ divorced ☐ widow ☐
▪ Occupation:	
▪ Past medical history	
▪ Past surgical history	
▪ History of trauma or any other neurological deficits	

1. *Past medical history:* _____

2. *Past surgical history:* _____

3. *History of trauma or any other neurological deficits:*

_____

_____

Outcome measures	*Pre-test*	*Post-test*
VAS, Visual Analogue Scale.		
Knee ROM: *Flexion* *Extension*		
Muscles Strength		
Knee circumferences		

مقياس اكسفورد للركبة

برجاء الإجابة علي الاسئلة التالية:

1- كيف تصف وجع الركبة الذي تعاني منه؟

لا يوجد =1 بسيط جدا =2 بسيط =3 متوسط =4 حاد =5

2- هل يسبب وجع الركبة صعوبة أثناء عملية النظافة الشخصية؟

- لا توجد صعوبة =1
- صعوبة بسيطة جدا =2
- صعوبة متوسطة =3
- صعوبة كبيرة للغاية =4
- استحالة القيام بها =5

3- هل هناك صعوبة في الركوب او النزول من السيارة (المواصلات العامة) بسبب أوجاع الركبة؟

- لاتوجد صعوبة =1
- صعوبة بسيطةجدا =2
- صعوبة متوسطة =3
- صعوبة كبيرة =4
- استحالة القيام بها =5

4- ما أقصي مدة للمشي قبل أن يصبح وجع الركبة حاد؟

- بدون ألم > 60دقيقة =1
- 16- 60 دقيقة =2
- 5- 15 دقيقة =3
- حول المنزل فقط =4
- لا أستطيع علي الإطلاق – أوجاع حادة عند المشي =5

5- بعد الجلوس لتناول الطعام, ما مقدار صعوبة القيام من علي الكرسي بسبب وجع الركبة؟

- لا يوجد وجع علي الإطلاق =1
- وجع بسيط =2
- وجع متوسط =3
- مؤلم جداً =4

- غير محتمل =5

6- هل تعرج اثناء المشي بسبب ركبتك؟

- نادراً/ أبداً =1
- أحياناً أو بداية الأمر =2
- عادة, وليس فقط في بداية الأمر =3
- معظم الوقت =4
- كل الوقت =5

7- هل تستطيع الانحناء ثم الاعتدال مرة أخري؟

- نعم بسهولة =1
- صعوبة خفيفة =2
- صعوبة متوسطة =3
- صعوبة كبيرة =4
- لا استطيع =5

8- هل يزعجك وجع الركبة أثناء النوم ليلا؟

- لا يوجد علي الإطلاق =1
- ليلة أو ليلتان فقط =2
- بعض الليالي =3
- معظم الليالي =4
- كل ليلة =5

9- إلي أي مدي يعيقك ألم الركبة عن القيام بأعمالك اليومية بما في ذلك الأعمال المنزلية؟

- لا يعيقني علي الإطلاق =1
- يعيقني إلي حد ما =2
- بشكل متوسط =3
- إلي حد كبير =4
- يعيقني تماما =5

- هل تشعر أن ركبتيك لا تحملاك وأنهما قد يتسببان في وقوعك؟

- نادرا / أبداً =1
- في بعض الأحيان / في أول الأمر فقط =2
- عادة / ليس في أول الأمر =3

- أغلب الأوقات =4
- في كل وقت =5

– هل تستطيع القيام بالتسوق اليومي بمفردك؟

- نعم بكل سهولة =1
- بصعوبة بسيطة =2
- بصعوبة متوسطة =3
- بصعوبة بالغة =4
- لا, مستحيل =5

– هل تستطيع ان تنزل السلالم؟

- نعم بسهولة =1
- بصعوبة قليلة =2
- بصعوبة متوسطة =3
- بصعوبة بالغة =4
- لا , مستحيل =5

وضع الدرجات لمقياس أكسفورد للركبة = 60 إجمالى

مقياس أكسفورد يحتوى على 12 عنصر كل عنصر يحتوى على 5 نقاط بالتدريج من (1–5) وبالتالى المقياس يتراوح اجمالى مابين (12–60)

الدرجة 12 تمثل أقل الأعراض أى أن مفصل الركبة فى وضع طبيعى غالبا.

الدرجة 60 تمثل أسوأ الأعراض أى أن مفصل الركبة فى حالة سيئة للغاية.

فى مقياس أكسفورد كلما قلت الأعراض كلما قل المقياس والعكس كلما زادت الأعراض كلما زاد المقياس.

أى أن المقياس يزيد قبل التدخل الجراحى ويقل بعد التدخل الجراحى.

Appendix 2: Ethical approval

Al Quds University	جامعة القدس
Faculty of Health Professions	كلية المهن الصحية
Jerusalem –Abu Dis	القدس – أبو ديس

Research Ethics Subcommittee of Faculty of Health Professions
Letter of approval

Feb. 14, 2023
Ref. No.: RESC/2023-8

Dear Applicants, (**Dr. Esra Hamdan, Mr. Qais Saleh**)
Program: **MSc Physiotherapy Department**

The Research Ethics subcommittee of the Faculty of Health Professions has recently reviewed your proposal entitled (**The Efficacy of Continuous Passive Motion Device After Traumatic knee injuries: An experimental physiotherapy study for improving knee Joint outcome**) submitted by (**Dr. Esra Hamdan**). Your proposal is deemed to meet the requirements of research ethics at Al-Quds University, but further assessment is required by the Central Research Ethics Committee of Al-Quds University. We wish you all best for the conduct of the project.

Hussein ALMasri
Research Ethics Subcommittee Chair
Faculty of Health Professions

Hussein ALMasri

CC: File
CC: Committee members

Al Quds University
Faculty of Health Professions
Dept. of Physiotherapy & Rehab.
Jerusalem –Abu Dis

جامعة القدس
كلية المهن الصحية
دائرة العلاج الطبيعي والتأهيل
القدس– أبوديس

التاريخ: 2023/2/26

حضرة السيد أسامة النجار المحترم
مدير عام الإدارة العامة للخدمات الصحية المساندة
تحية طيبة وبعد،

الموضوع: تسهيل مهمة السيد قيس إبراهيم محمد صالح
طالب الماجستير في العلاج الطبيعي من جامعة القدس

يهديكم برنامج الماجستير وقسم العلاج الطبيعي في جامعة القدس أطيب الامنيات ونتمنى من حضرتكم الموافقه على جمع المعلومات البحثية وذلك كجزء من رسالة الماجستير الخاصة بالباحث اخصائي العلاج الطبيعي " قيس صالح " والبحث باشراف الدكتورة اسراء حمدان وهو بعنوان "دراسة تجريبية لقياس فاعليه جهاز الحركات القصريه للمرضى الذين يعانون من محدوديه الحركيه في مفصل الركبه بعد الاصابه " .

والذي يهدف إلى التحقيق في تأثير تدخل العلاج الطبيعي على نتائج المدى الحركي والقدرات الوظيفية لمفصل الركبة بين المرضى بعد الاصابة وبشكل آمن ومهني ويناسب قدرات المرضى .
وسيتم جمع بيانات البحث من المرضى الذين سوف يتم تحويلهم للعلاج الطبيعي في مستشفيات وزارة الصحة الفلسطينية وبالأخص في مستشفى رفيديا /نابلس ، وسيتم الحفاظ على سرية وخصوصية المرضى واستخدام المعلومات لأغراض البحث العلمي . علما بأن البحث قد حصل على موافقة لجنة الاخلاقيات في كلية المهن الصحية / جامعة القدس بعد مناقشة مقترح البحث امام لجنة برنامج ماجستير العلاج الطبيعي ومع التأكيد ان الباحث قيس حاصل على مزاولة مهنة العلاج الطبيعي الفلسطينية ويعمل الان كأخصائي علاج طبيعي في مستشفى رفيديا الحكومي/ نابلس ولديه خبرة في التعامل مع المرضى والمريضات ما بعد اصابات الركبة .
آملين من حضرتكم الموافقة على تسهيل مهمة الطالب الاخصائي قيس صالح في جمع البيانات في الايام التي سيسمح بها المرضى وبعد التنسيق المسبق وفي أوقات العلاج والدوام المناسبة للجميع .

وتفضلوا بقبول فائق الاحترام والتقدير

د. اسراء حمدان
رئيس دائرة العلاج الطبيعي والتأهيل
Ehamdan2@staff.alquds.edu

- مرفق موافقة الاخلاقيات العلمية من جامعة القدس / مرفق نموذج استمارة البحث وقائمة الفحوصات والبرنامج العلاجي

023 10:17 From:

State of Palestine
Ministry of Health
Assistant Deputy for Allied Medical
Professions and Blood Banks

دولة فلسطين
وزارة الصحـــــة
الوكيل المساعد
للمهن الطبية المساندة وبنوك الدم

الاخ الدكتور معتصم محسن المحتـــــسب
الوكيل المساعد لشؤون المستشفيات والطوارئ

الموضوع: تسهيل مهمة .

تحية طيبة وبعد،،

بعد التحية وبالاشارة للموضوع أعلاه، يرجى تسهيل مهمة الطالب اخصائي العلاج الطبيعي قيس ابراهيم محمد صالح من جامعة القدس بإشراف الدكتورة اسراء حمدان لعمل مشروع بحث كجزء من رسالة الماجستير بعنوان:

(دراسة تجريبية لقياس فاعلية جهاز الحركات القصرية للمرضى الذين يعانون من محدودية الحركية في مفصل الركبة بعد الاصابة)

وذلك من خلال جمع بيانات البحث من المرضى الذين سوف يتم تحويلهم للعلاج الطبيعي في مستشفيات وزارة الصحة وبالأخص مستشفى رفيديا الحكومي، على ان يتم التعامل مع كافة المعلومات بسرية تامة وتستخدم لأغراض البحث العلمي فقط.

وتفضلوا بقبول فائق الاحترام،،

وارد دولة فلسطين
وزارة الصحة
مكتب الوكيل المساعد لشؤون المستشفيات والطوارئ
وارد رقم 2023/4473
التاريخ 15/3/2023

دولة فلسطين
وزارة الصحة
الإدارة العامة للمستشفيات
مستشفى رفيديا الحكومي
وارد
الرقم: ٦٤٥٦/٠١٠٢
التاريخ: ٢٠٢٣/٣/١٦

Lana

Appendix 3: Inform consent

Informed consent to Participate in Research

نموذج الموافقة على المشاركة في البحث

اسم البحث: "دراسة تجريبية لقياس فاعليه جهاز الحركات القصريه للمرضى الذين يعانون من محدوديه الحركيه في مفصل الركبه بعد الاصابه"

اسم الباحث : قيس ابراهيم صالح

Patient name: _____

Patient code: _____

Evaluator name: _____

Date of evaluation and signature: _____

عزيزي/تي المشارك/ة:

توقيعك ادناه على نموذج الموافقة هذا هو بموجب موافقة مكتوبة وموقعة على المشاركة في دراسة بحثية التي يقوم بها الباحث قيس ابراهيم صالح حول "***دراسة تجريبية لقياس فاعلية جهاز الحركات القصريه للمرضى الذين يعانون من محدوديه الحركيه في مفصل الركبه بعد الاصابه***"

و هو إقرار بانه قد تم شرح أهداف البحث و طريقة الفحص و التدخل العلاجي للبحث، وانه قد تم شرح حقوقك المتضمنة:

- سرية المعلومات التي تصرح بها وعدم إطلاع اى شخص عليها و تخزينها في مكان امن لا يصل اليه سوى الباحث.
- إخفاء هوية المشارك في تحليل البحث والنتائج.
- استخدام المعلومات للاغراض العلمية فقط.
- حرية إنسحابك في اى وقت من الدراسة ومن دون الحاجة لإبداء الأسباب ودون اية عواقب شخصية او مالية.
- حقك في الإطلاع على نتيجة فحوصاتك ونتائج البحث النهائية.

وأنه في حال كان لديك/ي أسئلة حول الدراسة او حول اي معلومة متعلقة بها, يرجى الاتصال بالباحث:

معلومات الاتصال:

تمت مراجعة هذا البحث والمصادقة عليه من قبل لجنة أخلاقيات البحث في جامعة القدس. إذا كانت لديك أي أسئلة أو مخاوف أخرى بشأن هذه الدراسة ، فيرجى الاتصال بـ:

اسم الباحث: الاخصائي قيس صالح
العنوان الكامل: عصيره القبلية-نابلس
0598159912 الجوال
بريد الالكتروني: qais.salah@students.alquds.edu

موافقة المشارك

لقد تم وصف الدراسة البحثية لي شفهيا، وبما فيه المعلومات المدرجة أعلاه، وأوافق على المشاركة بهذه الدراسة البحثية. سوف أحصل على نسخة موقعة من هذا النموذج للاحتفاظ بها في سجلاتي، أوافق على المشاركة بهذه الدراسة.

اسم المشارك/ة الرباعي: _____

توقيع المشارك/ة: _____ **التاريخ:** _____